



Revision 2  
December 28, 2012



## **OPERATION, MAINTENANCE, AND MONITORING PLAN**

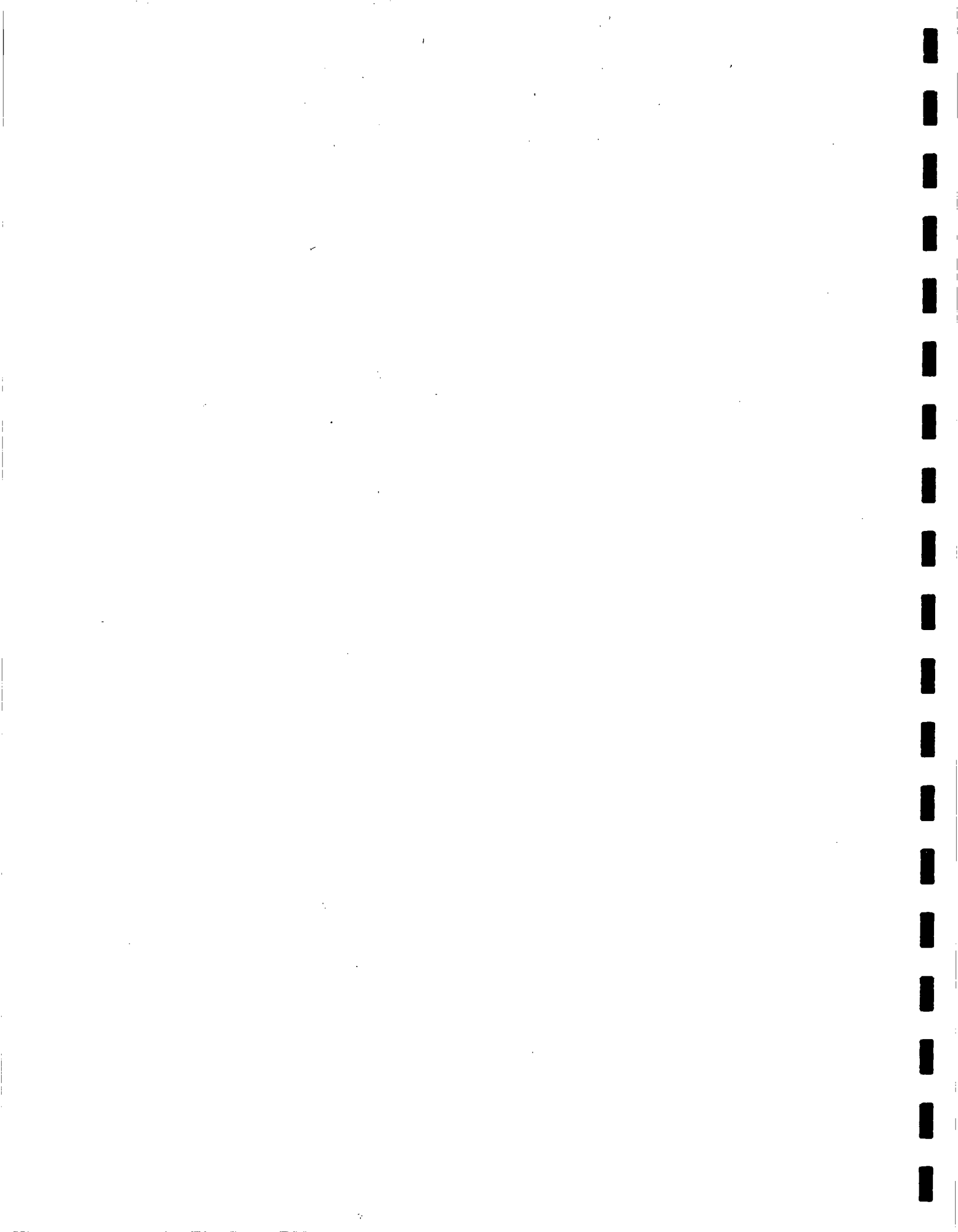
**12th STREET LANDFILL  
OTSEGO TOWNSHIP, MICHIGAN**

**Prepared For:**

**Operable Unit No. 4 of the Allied Paper, Inc./Portage Creek/  
Kalamazoo River Superfund Site**

**PRINTED ON:**

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Kalamazoo River Superfund Site**

**DECEMBER 2012  
REF. NO. 056393 (7)**

**Prepared by:  
Conestoga-Rovers  
& Associates**

2055 Niagara Falls Blvd.  
Suite Three  
Niagara Falls, NY 14304

Office: 716-297-6150  
Fax: 716-297-2265





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## 1.0 INTRODUCTION

On behalf of Weyerhaeuser NR Company (Weyerhaeuser), Conestoga-Rovers & Associates (CRA) has prepared this Operation, Maintenance, and Monitoring (OM&M) Plan for the 12<sup>th</sup> Street Landfill Operable Unit No. 4 (OU4), located at 481 12<sup>th</sup> Street North in Plainwell, Michigan (Site) in fulfillment of one of the requirements of the United States Environmental Protection Agency (USEPA) Consent Decree (CD) (Civil Action No. 1:05-CV0003) dated January 3, 2005. In accordance with the CD, the OM&M Plan will provide the methodologies to be followed for the operation, maintenance, and long-term monitoring of the remedy set forth in the OU4 Record of Decision (ROD), OU4 Scope of Work, OU4 Remedial Action Work Plan (RAWP), and for the achievement of the OU4 Performance Standards.

### 1.1 PURPOSE AND SCOPE

The ROD requires that deed restrictions be imposed on the 12<sup>th</sup> Street Landfill property as necessary to appropriately restrict future land use pursuant to Section 20120a (1)(i) of the Natural Resources and Environmental Protection Act, 1994, PA 451, as amended (NREPA) (i.e., for "limited industrial" land use). This OM&M Plan has been prepared in accordance with Section 20120b(3)(b and c) of Part 201, of the NREPA, and Rules R299.5538 and R299.5540 of the Part 201 administrative rules. This OM&M Plan outlines the requirements for site access control, the landfill cover, the erosion control measures, the groundwater monitoring system, and the passive landfill gas venting system. The groundwater and landfill monitoring activities are described in the Performance Standards Verification Plan (PSVP) (RMT, 2008), which is Appendix D of the Final Design Report prepared by CRA, dated March 2010 (Final Design Report)<sup>1</sup>. This OM&M Plan includes the following information:

- Operation and Maintenance Objectives (Section 3.0)
- Operation and Maintenance Activities (Section 4.0)
- Record Keeping and Reporting (Section 7.0)
- Emergency Response/Health and Safety Plan (Section 8.0)

This OM&M Plan will be made available to personnel performing OM&M activities. Properly trained and qualified OM&M personnel will perform the operation, maintenance, and monitoring of the Site. The recommended practices described in this document are based on typical and stabilized conditions. Unusual or unforeseeable

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<sup>1</sup> Relevant portions of the PSVP have been incorporated into this document as appropriate in place of providing the PSVP in its entirety as an appendix to the OM&M Plan.

conditions may require modification of these practices. Changes to this OM&M Plan resulting from changed conditions at the Site will be submitted to the USEPA. Revisions made to this OM&M Plan in the future will be tracked in Appendix A.

The scope of the activities described in this OM&M Plan includes the monitoring well network and gas probes. Monitoring wells and gas probes are situated on the property owned by Weyerhaeuser, located on the adjacent properties owned by the Michigan Department of Natural Resources (MDNR) and Aggregate Industries (leased by Wyoming Asphalt Company). The scope encompasses the components of the remedy installed as part of the Emergency Action performed in 2007 and performed as part of the Remedial Action (RA) performed in 2010.

## 2.0 DESIGN AND CONSTRUCTION DOCUMENTATION PLANS

The remedial construction for the 12<sup>th</sup> Street Landfill includes the following components:

- A landfill cover
- An erosion control system
- Site access controls
- A passive gas management system
- A gas monitoring system
- A groundwater monitoring network
- A river water monitoring system

A description of these components is presented below. As-Built Drawings were prepared based on surveying conducted by a Michigan licensed surveyor and quality control/quality assurance (QC/QA) field measurements and verifications and are provided in Appendix B for reference.

Drawings, signed and stamped by a professional engineer enclosed with this report are as follows:

- Drawing C-01 Overall Site Plan
- Drawing C-02 Subgrade Contours
- Drawing C-03 Passive Gas Management System
- Drawing C-04 Liner Placement
- Drawing C-05 Final Contours and Cross Section Locations
- Drawing C-06 Cross Sections I
- Drawing C-07 Cross Sections II
- Drawing C-08 Toe of Slope Details
- Drawing C-09 Erosion Control Measures
- Drawing C-10 Excavation Areas
- Drawing C-11 Typical Details I
- Drawing C-12 Typical Details II

## 2.1 LANDFILL COVER

Construction of the cover over the landfill was designed to meet the following objectives:

- To prevent the release of polychlorinated biphenyls (PCBs) to the environment
- To provide sideslope stability, flood protection, and erosion control
- To minimize infiltration of precipitation through the landfill
- To prevent migration of residuals or leachate from the landfill into the adjacent areas
- To eliminate direct contact hazards

The landfill cover was designed to meet the requirements of the ROD and the relevant portions of the current State of Michigan Solid Waste Management Act, Part 115 of the NREPA, 1994, Act 451, as amended (Part 115).

The landfill cover meets the requirements of Rule R299.4425(5) of Part 115, which allows for an alternative landfill cover design if the alternative landfill cover includes (a) an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in Sub rule (3), and (b) an erosion layer that provides equivalent protection from wind and water erosion as the erosion layer specified in Rule R299.4425(3).

The landfill cover consists of the following layers, from the bottom up:

- A fill layer consisting of 6 inches of select granular fill with a hydraulic conductivity of  $1.0 \times 10^{-2}$  centimeters per second (cm/sec)
- A barrier layer consisting of 40-millimeter (mil) linear low-density polyethylene (LLDPE) geomembrane with a hydraulic conductivity layer of  $4.0 \times 10^{-13}$  cm/s
- A conveyance layer consisting of geocomposite drainage material (geonet), placed directly above the 40-mil LLDPE liner
- A fill layer consisting of 24-inch thick general fill
- A vegetative layer consisting of a 6-inch thick topsoil layer

The top of paper residual grades and landfill cover grades are shown on Drawing C-02 – Subgrade Contours and Drawing C-05 – Final Contours and Cross Section Locations, respectively. The top area of the landfill has a minimum slope of 5 percent and a maximum slope of 4H:1V.

## 2.2 EROSION CONTROL SYSTEM

In accordance with the ROD, following the installation of the liner cover system (LLDPE geomembrane liner, geonet, and fill layer), an erosion control system consisting of a combination of riprap and a turf reinforcement mat was installed on the eastern side of the landfill adjacent to the Kalamazoo River (River). The Riverbank from approximately 698.0 to 702.5 above mean sea level (AMSL) was regraded to a 3H:1V slope and covered by riprap over a geotextile fabric. Upslope of the riprap, 6 inches of topsoil was placed across the bench at approximately 703.0 AMSL. From 702.5 to 707.0 AMSL, on the regraded 5H:1V sideslope, 6 inches of general fill material was installed on the eastern sideslope, overlain by 6 inches of topsoil. The topsoil was then covered with erosion control matting North American Green SC-250. The erosion control matting can be characterized by a three-dimensional composite of 70 percent straw and 30 percent coconut fibers.

In order to control erosion on the west side of the landfill, surface water runoff will be redirected by a combined access road/drainage ditch that discharges into the on-Site wetland to the north. Surface water runoff on the southern side of the landfill will be diverted to the east through a shallow ditch that directs runoff to the River for discharge. Surface water on the northern side of the landfill will be allowed to sheet flow off the cover system into a combined shallow ditch/access road that has V-notches along the outside of the ditch that enable collected surface water to discharge to the adjacent wetland to the north. The overall Site drainage and erosion control system is detailed on Drawings C-08 Toe of Slope Details and C-09 Erosion Control Measures. In addition, there are specific details for the perimeter drainage swales and drainage outlets presented on Drawing C-11, Details 5 through 9 of the As-Built Drawings included in Appendix B.

## 2.3 SITE ACCESS CONTROLS

Access restrictions to the landfill consist of fencing, a gate, locks, perimeter signs, and a permanent marker. The locations of the access controls are shown on Figure 2.

Yellow with black lettering perimeter signs stating "Caution Hazardous Substances Present No Trespassing No Hunting" placed on aluminum posts every 200 feet around the perimeter of the landfill will provide warning to the public. A permanent marker made of a granite slab installed on a concrete pad located adjacent to entry gate near the southwest corner of the landfill will also provide a permanent identification of the landfill area and the associated restrictions. The permanent marker text and a figure illustrating the entire property are shown on Figure 4.

All gas probes and monitoring wells are protected by a stickup metal cover with a locked lid. Inside each cover the top of casing on each monitoring well is capped with an expandable well plug.

The Site access controls described above are consistent with the access controls presented and approved in the Final Design Report. USEPA and Weyerhaeuser will evaluate the Site access controls to ensure that appropriate controls are in place long-term at the Site.

## **2.4 PASSIVE GAS MANAGEMENT SYSTEM**

In accordance with the ROD, the need for a gas management system was evaluated, and it was determined that it was necessary to vent landfill gas generated by the 12<sup>th</sup> Street Landfill. A passive gas system has been installed as part of the RA. The passive gas management system consists of the following components:

- A 6-inch select granular fill layer that has been installed on the top of the paper residuals (beneath the liner)
- A series of 11 passive gas vent locations, spaced approximately 200 feet apart across the surface of the landfill footprint, installed within the granular venting layer via a gravel pad at each gas vent location
- Each passive gas vent consists of 4-inch diameter "L-shaped" polyvinyl chloride (PVC) schedule 40 riser pipes penetrating through the landfill cover system (including boots through the liner) to vent any collected gas directly to the atmosphere

The passive gas management system is shown on As-Built Drawing C-03.

## **2.5 GAS MONITORING SYSTEM**

In accordance with the ROD, a gas monitoring system consisting of three gas probes has been installed around the southern boundaries of the landfill footprint. The locations of the gas probes are shown on Figure 3. Two gas probes have been installed as shallow monitoring locations (GP-1 and GP-3) and one gas probe (GP-2) has been installed as a deeper monitoring location. The shallow gas probes are installed to a depth of 4 to 5 feet below ground surface (bgs) with a 2-foot slotted pipe, and the deep gas probe is installed to a depth of approximately 30 feet bgs with a 25-foot slotted pipe. Gas probes have been constructed using a stopcock and hose barb assembly with a ½-inch PVC ball valve and a



1/2-inch threaded connector. Gas probe assemblies are contained at each location with a standard lockable well casing. Gas probe locations are presented on As-Built Drawing C-03. Table 1 provides a summary of the construction details for the three gas probes. Gas probe construction logs are provided in Appendix C.

## 2.6 GROUNDWATER MONITORING NETWORK

In accordance with the requirements of the ROD, a groundwater monitoring network consisting of 15 overburden monitoring wells has been installed around the perimeter of the landfill.

Based on Site conditions and results obtained from the vertical aquifer sampling completed prior to the monitoring well installations, six monitoring well pairs, consisting of a shallow groundwater monitoring well and a deep groundwater monitoring well, have been installed along the border of the landfill footprint. Two of the monitoring well pairs were installed at upgradient locations, with the other four monitoring well pair locations installed along the downgradient edges of the property. The remaining three monitoring wells consist of single well locations. The monitoring wells along the northern boundary of the landfill have been installed at approximately 200 feet on center. The shallow (i.e., screened at the water table) monitoring wells have been installed using a 7-foot screen, and the deep monitoring wells have been constructed with 5-foot screens.

Vertical aquifer sampling conducted prior to the installation of the monitoring well allowed for placement of the monitoring well screens at the depth interval that is representative of the highest level of impact. Vertical profiling was performed at 5-foot intervals from the water table to a depth of approximately 40 feet below the water table. Groundwater samples were also collected above and below low permeable units greater than 2 feet thick.

A 2-inch diameter 0.010-inch slot PVC screen with 2 inch schedule 40 PVC riser pipe was used to construct the monitoring wells. Filter sand (No. 4) was installed from the base of the well screen to 1 foot above the top of the well screen. A bentonite seal (hydrated pellets followed by bentonite-cement grout) extends from 1 foot above the top of the well screen to 2 feet below the ground surface. At a minimum, 2 feet of bentonite seal were placed above the top of the screen. The annulus was tremie-grouted from the bottom to the surface with a cement-bentonite grout. Concrete was added on top of the bentonite-cement grout and extended around the protective stickup cover to create a small pad. Riser pipes are capped with expandable well plugs. A lock cover is present at each protective stickup metal monitoring well cover. Monitoring wells have been constructed in accordance with American Society for Testing and Materials (ASTM)

method D-5092-90. The locations of the groundwater monitoring wells are shown on Figure 3. Details for the groundwater monitoring well construction are summarized in Table 1 with completion logs provided in Appendix C.

## 2.7 RIVER WATER MONITORING SYSTEM

A staff gauge was installed proximal to the northeast corner of the 12<sup>th</sup> Street Landfill, as shown on Figure 3 and in accordance with Standard Operating Procedure (SOP) F-10 provided in Appendix D. The staff gauge, SG-101, will be used to measure the water level of the River. The staff gauge has been installed along the River bank in a location so that River stage can be measured during relatively low River flows. Water level readings will be collected 3 days per week for 2 weeks prior to and at the start of each of the groundwater sampling events. The staff gauge reading will be recorded to the nearest 0.01 foot.

### 3.0 OPERATION AND MAINTENANCE OBJECTIVES

This section describes the OM&M objectives for the 12<sup>th</sup> Street Landfill. A detailed description of the operation and maintenance activities is included in Section 4.

The objectives of the OM&M program are to ensure the effective operation and maintenance of the following in a manner that ensures their long-term reliability toward meeting the objectives of the remedial design and the ROD:

- Landfill cover
- Erosion control system
- Site access controls
- Passive gas venting system
- Landfill gas monitoring system
- Groundwater monitoring system
- Staff gauge measurements

#### 4.0 OPERATION AND MAINTENANCE ACTIVITIES

This section describes the operation and maintenance activities for the 12<sup>th</sup> Street Landfill.

Components of Task 5 of the Statement of Work (SOW) relevant to the normal ongoing operations and maintenance at the Site include:

- Long-term maintenance of the landfill cover
- Erosion control
- Long-term groundwater monitoring
  - Semiannual
  - Quarterly
- Fencing, signage, and permanent markers
- Reporting

Operation and maintenance activities related to these components are discussed in the following sections.

At this time, the Site does not have any active systems (e.g., leachate or landfill gas collection) in operation. Quarterly and semiannual groundwater sampling and gas probe monitoring are conducted using portable equipment. Calibration records are maintained at CRA's Plainwell, Michigan office located at 200 West Allegan Street, Plainwell, Michigan 49080, approximately 2 miles from the Site.

#### 4.1 LANDFILL COVER

The landfill cover and adjacent areas disturbed and revegetated during construction, will be visually inspected on a quarterly basis for the presence of adequate vegetation, and evidence of erosion or subsidence that could lead to surface water ponding and burrowing by animals. Needed repairs will be noted by OM&M personnel on a Site inspection form and reported to a representative of Weyerhaeuser. Repairs will be completed within 30 days of discovery, weather and Site conditions permitting. In addition, the vegetative cover will be maintained as necessary to prevent the growth of woody plants. The inspection frequency will be reduced to semiannually after 2 years.

#### 4.2 EROSION CONTROL SYSTEM

Riprap installed in 2007 as part of the Time Critical Removal Action (TCRA) and the SOW within the CD provides the erosion protection from a 500-year flood event for the east side of the landfill along the River. The riprap, the erosion control matting, and vegetation below elevation 707 feet AMSL will be visually inspected quarterly for the presence of an adequate amount of riprap (no exposed geotextile), possible movement of the riprap, the presence of adequate and thriving vegetation, evidence of erosion or rutting, and signs of burrowing animals. Needed repairs will be noted by OM&M personnel on a Site inspection form and reported to a representative of Weyerhaeuser. During the erosion control system inspections, the perimeter drainage swales and outlets will be inspected to determine if maintenance activities, which may include, but are not limited to, the removal of sediments that have collected in the swales and outlets. Repairs to the erosion control system or maintenance of the swales or outlets will be completed within 30 days of discovery, weather and Site conditions permitting. In addition, the vegetative cover above 707 feet AMSL, along the River, will be maintained as necessary to prevent the growth of woody plants. The inspection frequency will be reduced to semiannually after 2 years.

#### 4.3 SITE ACCESS CONTROLS

Fencing, the gate, and lock will be inspected quarterly for signs of vandalism, deterioration, or damage. Needed repairs will be noted by OM&M personnel on a Site inspection form and reported to a representative of Weyerhaeuser. Repairs will be completed within 30 days of discovery, weather and Site conditions permitting. The inspection frequency will be reduced to semiannually after 2 years.

#### 4.4 GAS VENTS

Gas vents will be inspected quarterly for structural integrity and identification labels. Needed repairs to the vents will be noted by OM&M personnel on a Site inspection form and reported to a representative of Weyerhaeuser. Repairs will be completed within 30 days of discovery, weather and Site conditions permitting. A description of potential contingency actions for the gas venting system is provided in the following section. The inspection frequency will be reduced to semiannually after 2 years.

#### 4.5 GAS PROBES

The gas probes will be inspected quarterly for structural integrity, the presence and the condition of locks, and identification labels. Needed repairs to the gas probes will be noted by OM&M personnel on a Site inspection form and reported to a representative of Weyerhaeuser. Repairs will be completed within 30 days of discovery, weather and Site conditions permitting. If combustible gas (measured as a percentage by volume) is detected in any of the gas probes along the property boundary above background levels, but below 25 percent of the Lower Explosive Limit (LEL), then one or more of the following actions may be taken on the basis of the combustible gas level in the probe(s):

- Recalibrate gas meter and perform confirmatory monitoring.
- Conduct monitoring at an increased frequency (monthly or weekly) at the affected probe(s), as well as nearby probes, until the combustible gas level in the probe(s) returns to background. The monitoring frequency will be dependent on the field conditions.

If combustible gas is detected in any of the gas probes at or above 25 percent of the LEL, then one or more of the following actions, in addition to those listed above, may be taken on the basis of the combustible gas level in the probe(s):

- Conduct a borehole investigation to determine the extent of the subsurface gas migration.
- As appropriate, install additional permanent gas monitoring probes.
- Evaluate the need to install the gas vents in the area around the gas probe(s) if they are not already present.

If combustible gas is detected in any of the gas probes at or above the LEL, then one or more of the following actions, in addition to those listed above, may be taken:

- If the presence of combustible gas at or above the LEL is confirmed, notify the USEPA and the Michigan Department of Environmental Quality (MDEQ) within 48 hours.
- Conduct a real-time survey (using a hand-held instrument) of potential points of subsurface gas entry into occupied structures near the affected probe(s).
- Install continuous gas monitors in any nearby occupied structures.
- Evaluate the need to install a localized or Site-wide active gas extraction system based on potential risks to human health and the environment and on discussions with the USEPA and the MDEQ.

Additional actions may be selected and implemented as quickly as possible, dependant on the availability of equipment, material, and contractors, and on the locations of the probe(s) where the exceedance occurred.

If nuisance odors are detected at a property line, then one or more of the following actions may be taken based on field observations and Site conditions:

- If the source of the odors cannot be eliminated within 24 hours, notify the USEPA and the MDEQ.
- Determine the areal extent and temporal conditions under which the nuisance odors are observed.
- Conduct monitoring at an increased frequency (monthly or weekly) at the affected area(s) as well as at nearby gas probes, until the odor dissipates. The monitoring frequency will be dependant on the field conditions.
- Evaluate the need to install a localized or Site-wide active gas extraction system based on potential risks to human health and the environment and on discussions with the USEPA and the MDEQ.

Additional actions may be selected and implemented as quickly as possible, dependant on the availability of equipment, material, and contractors, and on the locations of the probe(s) where the exceedance occurred. A reduction in the monitoring frequency may be proposed to the USEPA after evaluating the data from the first 2 years.

#### 4.6 GROUNDWATER MONITORING WELL MAINTENANCE

The groundwater monitoring wells will be inspected quarterly for structural integrity and the presence and condition of locks and identification labels. Needed repairs to the groundwater monitoring wells will be noted by OM&M personnel on a Site inspection report and reported to a representative of Weyerhaeuser. Repairs will be completed within 30 days of discovery, weather and Site conditions permitting.

A contingency plan has been developed in the event that a change occurs that reduces or limits the effectiveness of the remedial action in protecting human health and the environment. The need to undertake contingency response actions will be based on the specific situation encountered and on relevant information available at the time.

If the validated concentration of a constituent of potential concern in a monitoring well exceeds its groundwater surface water interface (GSI) criterion, then the result will be

evaluated to determine its significance and its potential to adversely affect human health, wildlife, or aquatic life, and to determine if a response action is needed.

A situation-specific response plan to evaluate the significance of the exceedance will be developed and submitted to USEPA. Such a plan will be based on the significance of the situation and may include one or more of the following actions:

- Resampling the well to confirm the presence and concentration of the constituent of concern
- Sampling the well with the exceedance at an increased frequency and evaluating trends over time
- Measuring the hardness (as calcium carbonate) of the River, and possibly recalculating the Site-specific GSI criteria for certain metals
- Requesting a mixing zone determination (MZD)
- Sampling background monitoring wells
- Conducting other appropriate Site-specific actions

If, following the implementation of the situation-specific response plan, an exceedance is determined to be significant, then additional investigation or corrective actions may be undertaken. In some circumstances, additional information may be needed in order to select an appropriate corrective action. For these situations, a pre-corrective action plan may be submitted to USEPA for review prior to implementing a corrective action plan.

As appropriate, alternative corrective actions will be developed and screened on the basis of effectiveness, implementability, cost, and restoration time. Best professional judgment will be used to identify a corrective action that meets Site-specific objectives. The process to select an appropriate corrective action will be streamlined as much as possible by focusing on practical, cost-effective alternatives. On the basis of the evaluation of alternative corrective actions, Weyerhaeuser will propose a selected corrective action to USEPA. Upon approval by the USEPA, Weyerhaeuser will implement said corrective action.

A reduction in the monitoring frequency may be proposed to the USEPA after evaluating the data from the first 2 years.



## 5.0 GROUNDWATER MONITORING PROGRAM

Groundwater monitoring is to be conducted in accordance with the FSP and the results compared to the State of Michigan Part 201 GSI criteria (included in Table 4.1 in the PSVP of the Final Design Report, Appendix D) and the Toxic Substances Control Act (TSCA) (40 CFR Section 761.75[b] [6], which describes the monitoring system requirements for chemical waste landfills). The long-term groundwater monitoring program requires groundwater monitoring on a quarterly basis for the first 2 years following installation of the groundwater monitoring wells. Each year of monitoring is to include two semiannual monitoring events and two quarterly monitoring events. Water levels will be recorded a minimum of three times per week for the 2 weeks preceding the groundwater sampling event. Water levels will be measured in the monitoring wells and the River gauge to verify that flow is toward the River. Each monitoring event will include confirmatory monitoring the day of the event to verify water levels are indicative of flow towards the River. Groundwater sampling will begin with samples taken from wells that are closest to the River to reduce the influence on flow across the landfill footprint. Sampling order may change based on the results from the first sampling event. To prevent cross-contamination, wells that exhibit the highest concentrations of laboratory analytes will be sampled last. The proximity of each well to the River will be incorporated into this protocol. The field procedures that will be used for groundwater monitoring will be performed in accordance with SOP F-11, provided in Appendix D, with the following exceptions:

- SOP F-11: The vertical reference point for surveyed information is the North American Vertical Datum 29 U.S. Survey feet (instead of the North American Vertical Datum 88)
- SOP F-11: If sampling results show the decontamination and purge water quality meets applicable Part 201 criteria, then the water can be discharged to ground surface (instead of transported off Site for disposal)

The following sections describe the groundwater activities that will characterize the long-term groundwater monitoring program on a quarterly and semiannual basis.

### 5.1 SEMIANNUAL GROUNDWATER MONITORING PROGRAM

Based on the results of the groundwater sampling that was conducted as part of the Remedial Investigation (RI), and the nature of the fill materials disposed in this landfill, the following analytical program has been developed for the Semiannual Monitoring Program. A complete list of laboratory analytes is shown in Quality Assurance Project Plan (QAPP) Worksheet #15-6 (May 2010).

SEMIANNUAL MONITORING PROGRAM	
<i>Laboratory Analytes</i>	<i>Field Measurements</i>
• PCBs	• Groundwater levels
• Dioxins and furans	• Surface water level
• TAL Inorganics	• Turbidity
• Cyanide	• Temperature
• TCL SVOCs	• pH
• TCL VOCs	• Conductivity
• Mercury (low level)	• Dissolved Oxygen
• Hexavalent Chromium and Trivalent Chromium	• Oxygen Reduction Potential

TAL Target Analyte List  
TCL Target Compound List  
VOCs Volatile Organic Compounds  
SVOCs Semi-Volatile Organic Compounds

## 5.2 QUARTERLY GROUNDWATER MONITORING PROGRAM

Based on the results of the groundwater sampling that was conducted as part of the RI, and the nature of the fill materials disposed in this landfill, the following analytical program has been developed for the Quarterly Monitoring Program. A complete list of laboratory analytes is shown in Table 4.3 in the PSVP (Appendix D of the Final Design Report).

QUARTERLY MONITORING PROGRAM	
<i>Laboratory Analytes</i>	<i>Field Measurements</i>
• PCBs	• Groundwater levels
• TCL VOCs	• Surface water levels
• Sodium	• Turbidity
• Mercury (low level)	• Temperature and pH
• Cyanide	• Dissolved Oxygen
• Magnesium	• Conductivity and Oxygen Reduction Potential

PCBs and VOCs are included in the quarterly sampling because they are known to be in the landfill residuals. Sodium, mercury, cyanide, and magnesium are included in the quarterly monitoring program because these are a subset of the semiannual monitoring analytes that are leachable and typical of a variety of waste materials.

### 5.3. FIELD QUALITY CONTROL SAMPLES

Field QC samples will be collected to assess the quality of the analytical data and to evaluate sampling and analytical reproducibility. Field QC samples will consist of field duplicate samples and triplicate blanks and equipment/rinsate blanks.

#### Field Duplicate Samples

Field duplicate samples, prepared by splitting a single sample between two separate bottle sets, will be used to evaluate sampling and analytical reproducibility (precision). These samples will be collected at a rate of one duplicate for every ten environmental water samples; however, duplicate collection will not be less than one per sampling event. Duplicate samples are to be collected to provide a range of expected concentrations of constituents of potential concern in the field and will be submitted as blind duplicates to the laboratory. By selecting duplicate samples from areas that are free from landfill effects and from areas that are suspected or known to have been affected by the landfill, the QC performance can be reviewed. Blind duplicate sample locations will be identified in the field notes, but not on sample labels or chain-of-custody records.

#### Trip Blanks

Trip blanks will be analyzed to assess the possible cross-contamination of VOCs resulting from diffusion or ambient contaminants through septa during sample shipment, as well as from possible contamination during bottle preparation. Trip blank samples will consist of three 40-milliliter (mL) vials that are filled with deionized water in the laboratory prior to being shipped to the field. Trip blanks will accompany the VOC water sample bottles from the lab to the field and will be returned with the VOC samples to the laboratory. A separate trip blank will be included in every shipping container that includes water samples intended for VOC analysis. The trip blanks will be analyzed at a rate of one trip blank for every daily shipment of ten samples or less that the laboratory receives. (If more than ten water samples in a day are collected for VOC analysis, additional trip blanks, as needed, will be analyzed). Trip blanks will be identified using "TB" as a station number.

#### Field Equipment Rinsate Blanks

Field equipment rinsate blanks will be collected by passing laboratory purified water over and/or through the respective field equipment utilized during each sampling effort. One rinsate blank will be collected during each event or every ten decontamination events, whichever would be more frequent. Field rinsate blanks will be analyzed for each target parameter for the respective sampling effort for which environmental media have

been collected. (Note: If dedicated or disposable sampling equipment is used, equipment rinsate samples may not be collected as part of that field effort).

#### 5.4 LABORATORY ACCURACY SAMPLES

Analytical bias will be assessed through the use of known laboratory control samples (LCS) and Site-specific matrix spike (MS) sample analyses. LCS and matrix spike/matrix spike duplicate (MS/MSD) sample analysis will be performed as prescribed by the analytical method SOPs. LCS analyses will be performed with each analytical batch of project samples to determine the accuracy of the analytical system.

One set of MS/MSD analyses will be performed with each batch of 20 project samples to assess the accuracy of identification and quantification of analytes within the Site-specific sample matrices. Additional sample volume will be collected at sample locations selected for MS/MSD analyses so that minimum detection limits (MDLs) and estimated quantitation limits (EQLs) can be met.

The results of the LCS and MS/MSD analyses will be presented in a summary table reporting format and evaluated versus the acceptance criteria presented in the laboratory analytical reports in the data validation memoranda. Current acceptance criteria are presented in the laboratory reference data provided in the QAPP.

The accuracy of organic parameter analyses is also monitored through the analysis of system monitoring or surrogate compounds. Surrogate compounds are added to each sample, standard, blank, and QC samples prior to the sample preparation and analysis. Surrogate compound percent recoveries provide information on the effect of the sample matrix on the accuracy of the analyses and are evaluated against the acceptance criteria presented in laboratory analytical reports. Current acceptance criteria are presented in the laboratory reference data provided in the QAPP.

Field Parameters <sup>(1)</sup>	Laboratory Parameters <sup>(2)</sup>	Investigative Samples per Quarterly Event <sup>(3)</sup>	Investigative Samples per Semiannual Event <sup>(3)</sup>	Field Quality Control Samples				Rinsate Blanks		Lab Matrix Sample	
				Field Duplicates		Trip Blanks		Freq <sup>(6)</sup>	Total	Freq <sup>(10)</sup>	Total
				Freq <sup>(4)</sup>	Total	Freq <sup>(5)</sup>	Total				
pH, ORP, Specific Conductance, Temperature, Turbidity	Volatile Organics	15	15	1	4		8 to 10 (est.)	1	4	1	4
	PCBs <sup>(7)</sup>	15	15	1	4			1	4	1	4
	Metals <sup>(8)</sup> (TAL)	0	15	1	2			1	2	1	2
	Cyanide	15	15	1	4			1	4	1	4
	Inorganic Indicators <sup>(9)</sup>	15	15	1	4			1	0	1	4
	SVOCs	0	15	1	2			1	2	1	2
	Dioxins and Furans	0	15	1	2			1	2	1	2
	Mercury (Low Level)	15	15	1	4			1	4	1	4
	Hexavalent and Trivalent Chromium	0	15	1	4			1	2	1	2

Notes:

- (1) Field parameters will be measured at the time of sample collection.
- (2) Laboratory analyses will be performed by WATS and Columbia analytical Services Laboratories, in accordance with the QAPP (RMT, 2008c). Laboratory methods and target detection limits are listed in Table 4-3 of the PSVP.
- (3) The number of samples includes monitoring wells installed around the perimeter of the landfill in 2010.
- (4) One field duplicate sample will be collected per ten investigative samples.
- (5) One trip blank sample will be submitted for analysis per cooler containing samples for VOC analysis.
- (6) Rinsate blank samples will be collected at a frequency of one per ten equipment decontamination events or one per event.
- (7) Includes Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260.
- (8) The specific metals, the analytical methods, and the target detection limits are listed in Table 4-3 of the PSVP. Samples for metals analysis will not be filtered.
- (9) The specific inorganic indicator parameters (sodium and magnesium), the analytical methods, and target detection limits are listed in Table 4-3 of PSVP.
- (10) MS/MSD will be collected at each event.

ORP     Oxidation-reduction potential.

## 5.5     GROUNDWATER MONITORING NETWORK AND SCHEDULE

The monitoring wells will be monitored quarterly and semiannually for the first 2 years after installation of the groundwater monitoring wells. Each year includes two semiannual sampling events and two quarterly sampling events. Semiannual sampling events will be conducted during the winter and summer seasons. Winter

season semiannual sampling will be conducted during the months of December/January/February (weather permitting), and summer season semiannual sampling events will be conducted during the months of June and/or July. Quarterly sampling events will be conducted during the spring and fall seasons. Spring season quarterly sampling events will be conducted during the months of March, April, or May, and fall season quarterly sampling events will be conducted during the months of October and/or November. A monitoring schedule is provided in Table 2.

Section II.4 of the SOW specifies the process for reducing the frequency of monitoring and the analytical program as follows:

"After at least two years of sampling under the Semiannual Monitoring and Quarterly Monitoring Programs, Weyerhaeuser may petition to discontinue the Quarterly Monitoring program and sample only on a semiannual sampling frequency. Weyerhaeuser may at that time also petition to limit the number of parameters included in the Semiannual Monitoring program. After at least two years of sampling on only a semiannual basis, Weyerhaeuser may petition USEPA to switch to only performing the monitoring on an annual basis if there has been no significant change in sampling results between sampling events. After at least 5 years of sampling on an annual basis only, Weyerhaeuser may petition USEPA to switch to a sampling frequency of once every 5 years if there has been no significant change in sampling results between sampling events. The samples collected on a five-year basis shall be analyzed for the parameters specified in the original Semiannual Monitoring program. Each petition under this task is subject to USEPA review and written approval. USEPA reserves the right to require Weyerhaeuser to sample on a more frequent basis, and/or for additional parameters, based upon data indicating a significant change in sampling results between sampling events."

The SOW also states that the continued need for groundwater monitoring will be evaluated at each 5-year review until the USEPA, in consultation with the support Agency, determines that such monitoring is no longer needed.

The first 5-year review after the Remedial Action was completed was conducted in August 2012.

## 6.0 LANDFILL GAS MONITORING PROGRAM

Three landfill gas probes have been installed outside of the landfill footprint on three sides. The locations of the gas probes are shown on Figure 3. The landfill gas monitoring probes will be monitored for combustible gas (i.e., methane), carbon dioxide, oxygen, and pressure on a quarterly basis for the first 2 years. Details regarding how the landfill gas monitoring will be performed and a description of contingency actions that may be taken if the performance standard is exceeded are described in Section 4.5 of this document. A monitoring schedule is provided in Table 2.

## 7.0 RECORD KEEPING AND REPORTING

### 7.1 RECORD KEEPING

Maintenance, repairs, and inspections will be recorded on a Site inspection form and reported to a representative of Weyerhaeuser. Copies of blank forms are included in Appendix F. Hard copies will be kept at CRA's Plainwell, Michigan office located at 200 West Allegan Street, Plainwell, Michigan 49080.

### 7.2 REPORTING

Reporting will be conducted on an annual basis for the previous year. The Annual Report will be submitted to the USEPA. Annual reports will include a summary of operation, maintenance, monitoring, inspection, and repair activities. Each annual report will include an assessment of the effectiveness of the remedy. The results for each groundwater monitoring event will be reported to the USEPA as follows:

- Validated data will be presented in a memorandum. The data will be presented in summary data tables and may not include any interpretation.
- The report will be submitted to USEPA approximately 6-8 weeks after the validated laboratory data are received. These reports will include groundwater/river gradient data, well purging data and sample collection records, summary data tables, method detection limits, and the laboratory reports. The groundwater/river gradient data will be presented in tables and organized by date and location of monitoring points. Calculations will be included in appendices.
- An annual report will be prepared for each calendar year in which groundwater monitoring was performed. These reports will include a more detailed analysis of the data, including trend analyses and an evaluation of the adequacy of the monitoring network in meeting its intended objectives. The reports will be submitted to USEPA within approximately 90 days of receipt of the validated data from the last event of the calendar year.

A summary of the documentation in the Annual Report that will be provided to USEPA can be found under Section 4.5 of the PSVP (Appendix D of the Final Design Report).

#### 7.2.1 OPERATION AND MAINTENANCE

A summary of the maintenance, inspection, and repair activities conducted over the year will be included in the annual reports for the Site.



### 7.2.2 MONITORING

A summary of monitoring activities described in the PSVP of the Final Design Report will be included in the annual reports, which will include the following information:

- **Landfill gas probes and vent locations** - A summary of the data collected during the monitoring activities and comparison to the Performance Standards
- **Groundwater monitoring wells** - A summary of the data collected during the sampling activities and comparison to the Performance Standards

### 7.2.3 GENERAL

The annual report will also include an assessment of the effectiveness of the institutional controls (in place at the time of the report) in preventing unauthorized access to the landfill and potential exposure to the paper residuals and landfill gas. A description of any contingency response actions taken as a result of unanticipated or changing conditions related to the landfill will be documented in the annual reports. Minor events that were corrected during the reporting year will be documented in the annual reports.

Conditions that pose an immediate threat to health, safety, or the environment will be reported to the USEPA, the local Fire Department, and/or the Allegan County Health Department within 24 hours from the time that the threat is identified. Otsego Township officials will also be notified as appropriate. The telephone numbers for these parties are provided in the Health and Safety Plan in Appendix E.

## 8.0 EMERGENCY RESPONSE AND SAFETY PLAN

This section describes the general emergency response and safety guidelines for the OM&M activities at the landfill. Occupational Safety and Health Administration's (OSHA's) and Weyerhaeuser's safety requirements are also applicable to the Operation and Maintenance (O&M) activities.

### 8.1 SAFETY GUIDELINES

Personnel performing OM&M activities should be aware of the following potential health and safety concerns:

- A fire or explosion could occur if there is a spark in the presence of landfill gas
- Landfill gases could cause an oxygen-deficient atmosphere in the gas vents or in low-lying areas
- Hydrogen sulfide, a highly toxic and flammable gas, may be present in the gas vents or gas probes

General safety precautions for OM&M activities include the following:

- OM&M personnel will be made aware of the potential presence of landfill gas, the hazards associated with the gas, and the recommended safety precautions established to protect workers and the public from exposure to landfill gas
- No welding or other potential sources of ignition will be allowed in enclosed areas or over the waste disposal areas unless these activities are performed over ground mats or in areas of the Site approved for this purpose by Weyerhaeuser
- Smoking will be prohibited on the landfill property
- High visibility clothing should be donned while working at the Site due to known hunting activity in the area
- OM&M personnel will keep a safe distance from the River and use the buddy system when working near the water

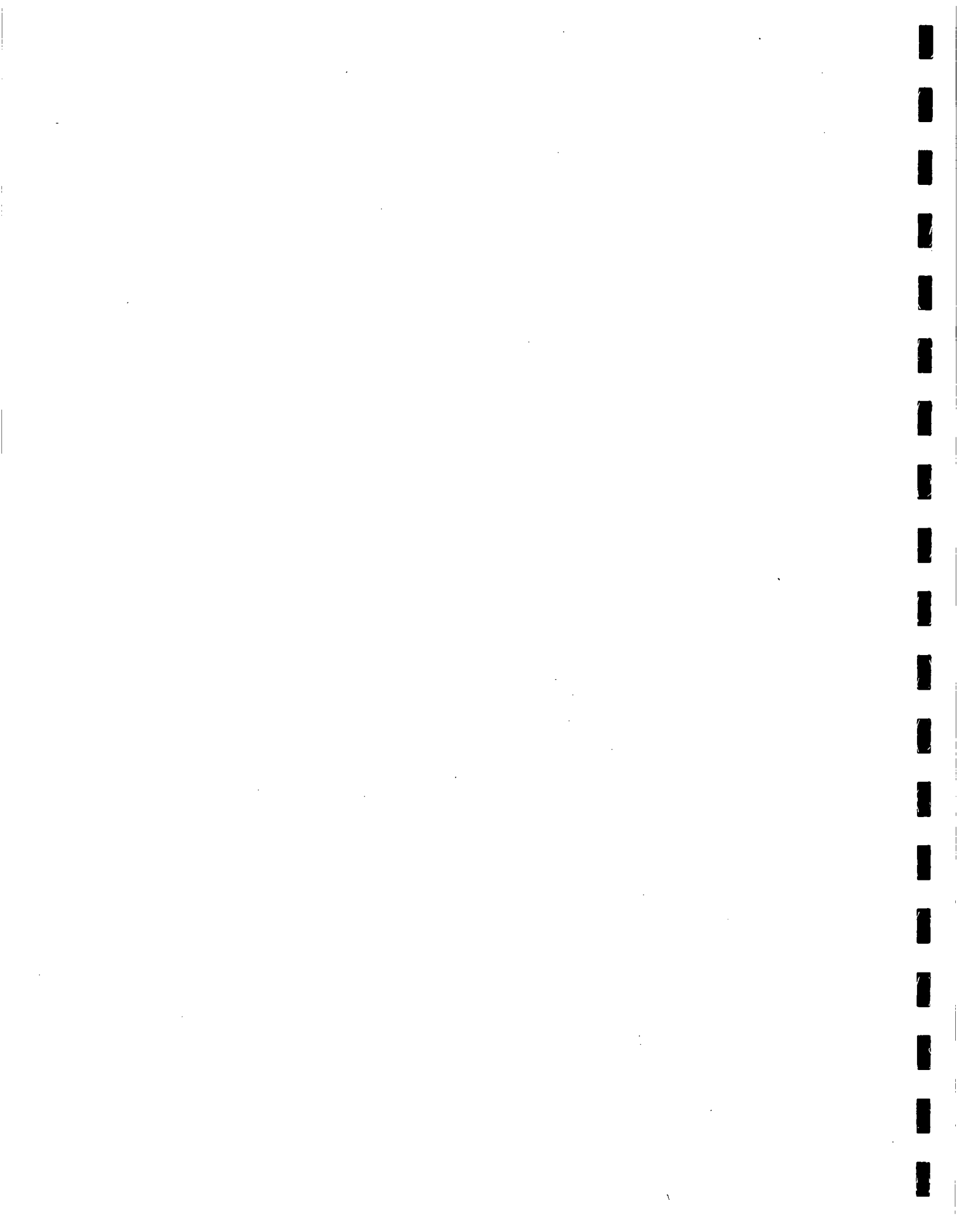
## 8.2 EMERGENCY RESPONSE GUIDELINES

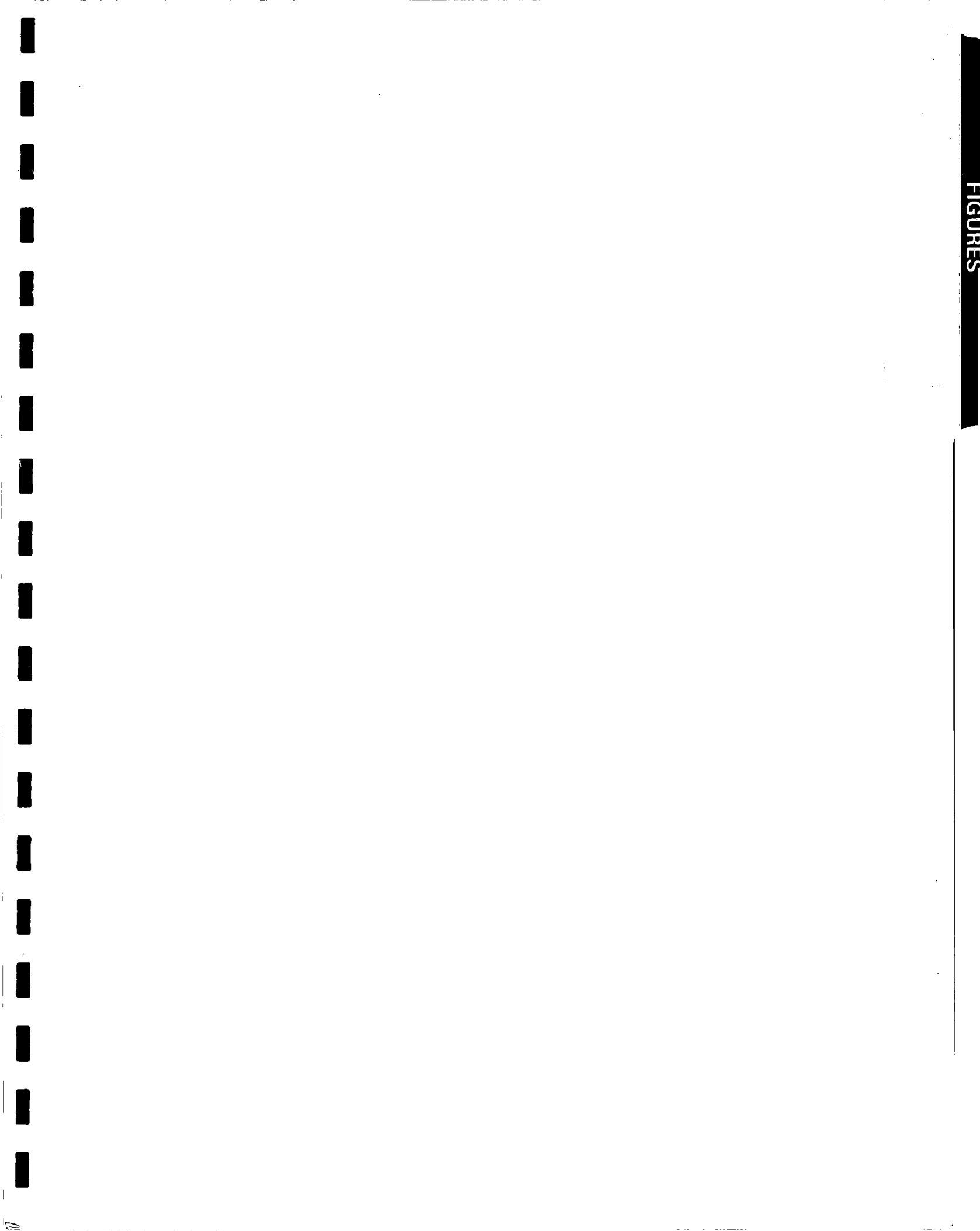
The following emergency situations could arise during the performance of the OM&M activities:

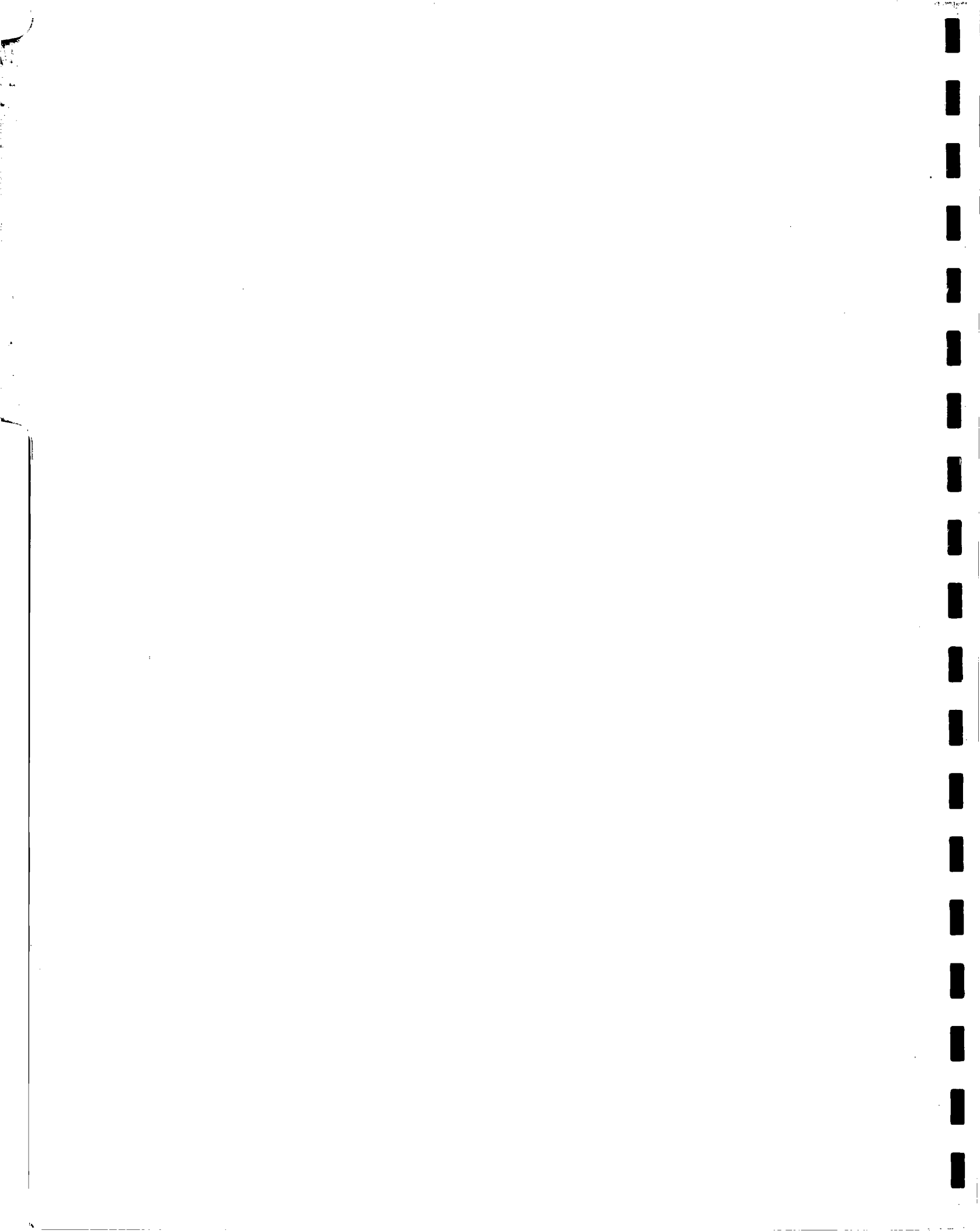
- An explosion or fire associated with the gas venting system
- Overexposure to inhaled landfill gases
- Vehicle accidents
- Hunter interaction/accidents

Emergency response guidelines for OM&M activities include the following:

- Within 24 hours from the time a potential emergency is identified, notify the following Agencies:
  - USEPA Remedial Project Manager
  - MDEQ Superfund Project Manager
  - MDEQ Pollution Emergency Alerting System (PEAS)
  - Local Fire Department or County Health Department
  - Otsego Township officials
- Notify the appropriate local public emergency response agency (e.g., fire, police, or ambulance)
- As conditions warrant, notify other personnel at the Site
- If evacuation of the Site is necessary, direct all personnel to the main entrance along 12<sup>th</sup> Street
- Notify the Weyerhaeuser Site representative, as soon as possible



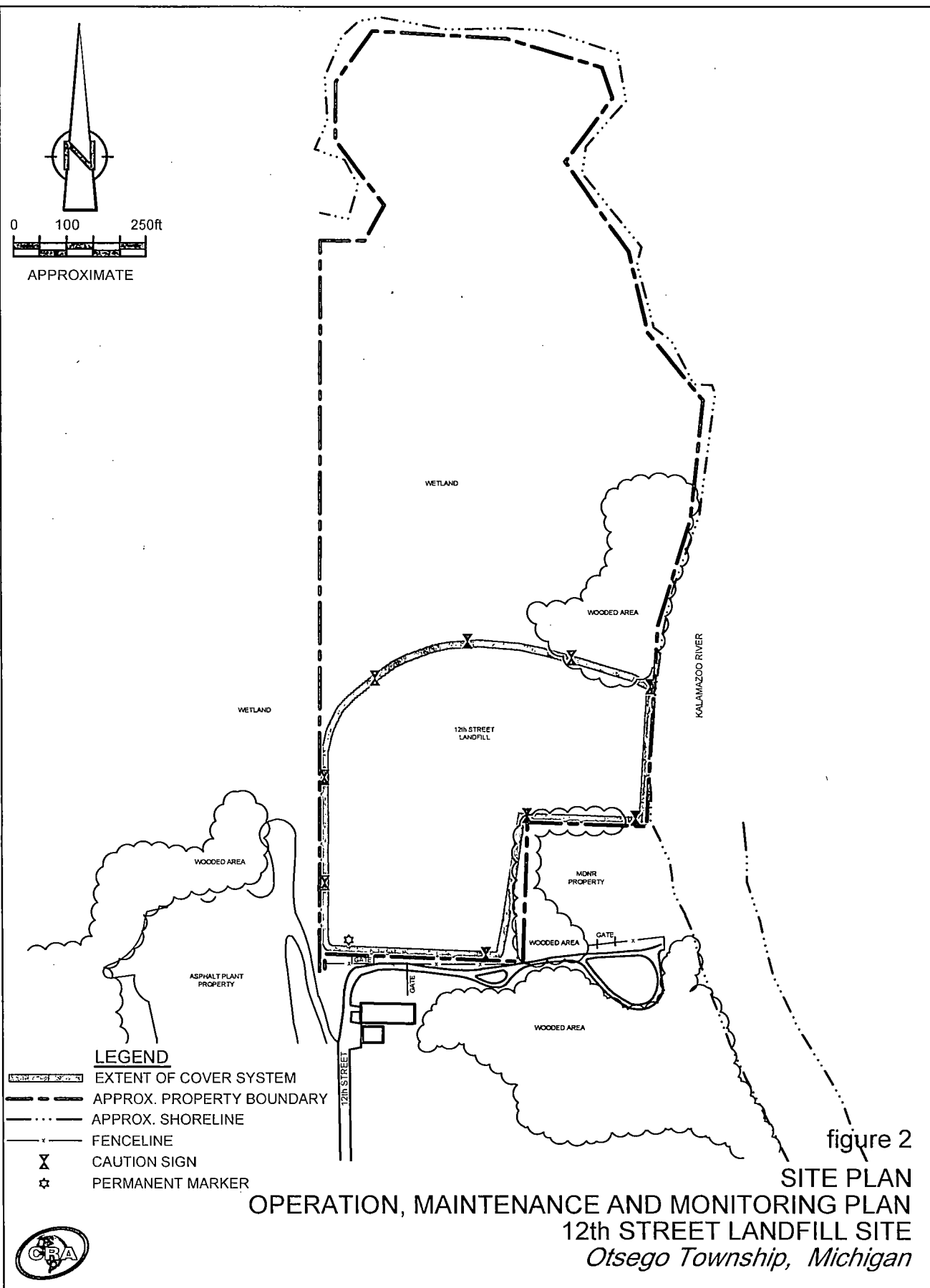




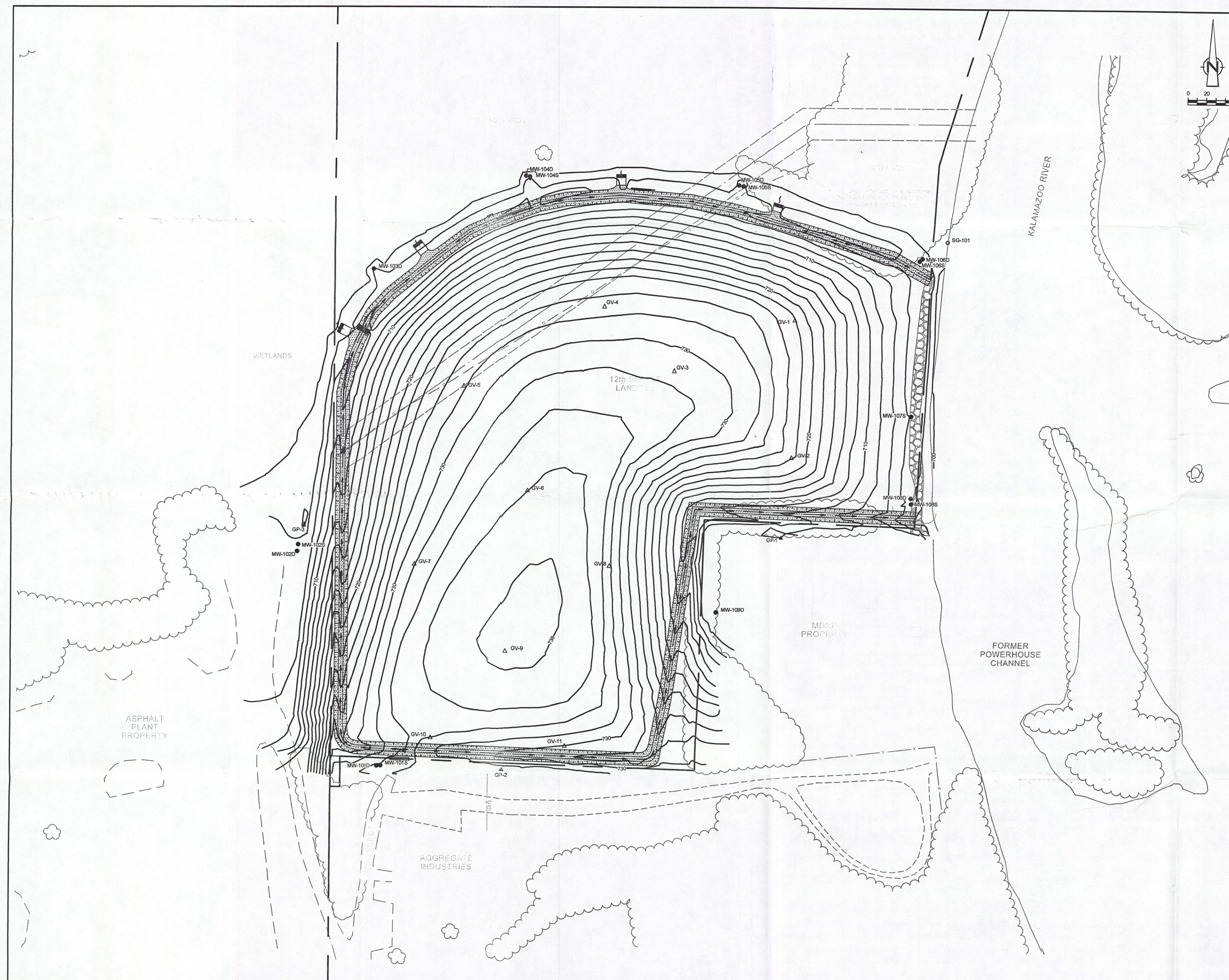










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**LEGEND**

- 
- |  |                                  |
|--|----------------------------------|
|  | APPROXIMATE PROPERTY BOUNDARY    |
|  | EXISTING PAVED ROAD              |
|  | EXISTING UNPAVED ROAD            |
|  | EXISTING EDGE OF WATER           |
|  | EXISTING TREES AND/OR BRUSH      |
|  | FINAL ELEVATION CONTOURS         |
|  | ROAD/DRAINAGE SWALE              |
|  | GV-1 GAS VENT LOCATION           |
|  | MW-106S MONITORING WELL LOCATION |
|  | GP-1 GAS PROBE LOCATION          |
|  | SG-101 STAFF GAUGE LOCATION      |

## SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

## DRAWING STATUS

[illegible]

12th STREET LANDFILL  
OTSEGO TOWNSHIP, MICHIGAN

OM & M  
MONITORING LOCATIONS

**CONESTOGA-ROVERS & ASSOCIATES**

Source Reference:

BASE ADAPTED FROM PREVIOUS RMT DESIGN

Project Manager:  
J. DEMBOWSKI

Reviewed By:	G. CARL
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Date: **DECEMBER 2012**

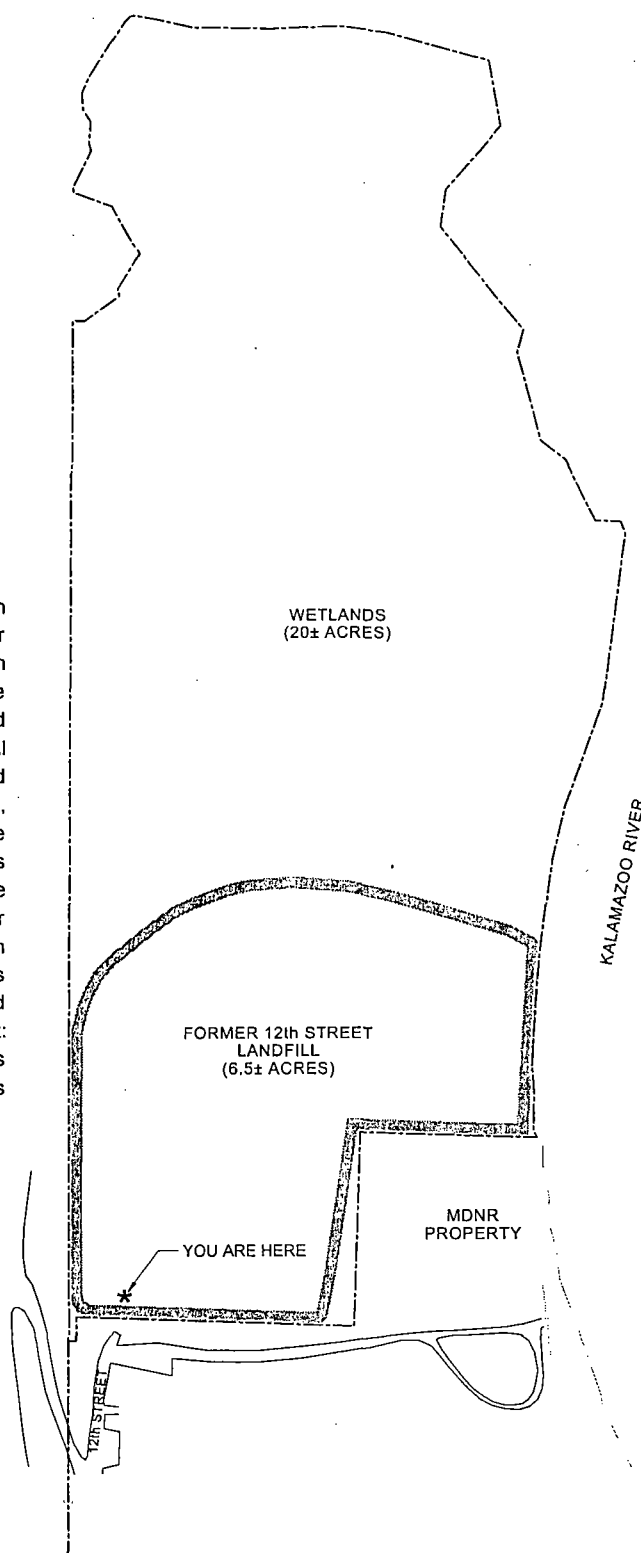
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Project N°:	56303 08
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Report N <sup>o</sup> :		Drawing N <sup>o</sup> :
007		figure 3







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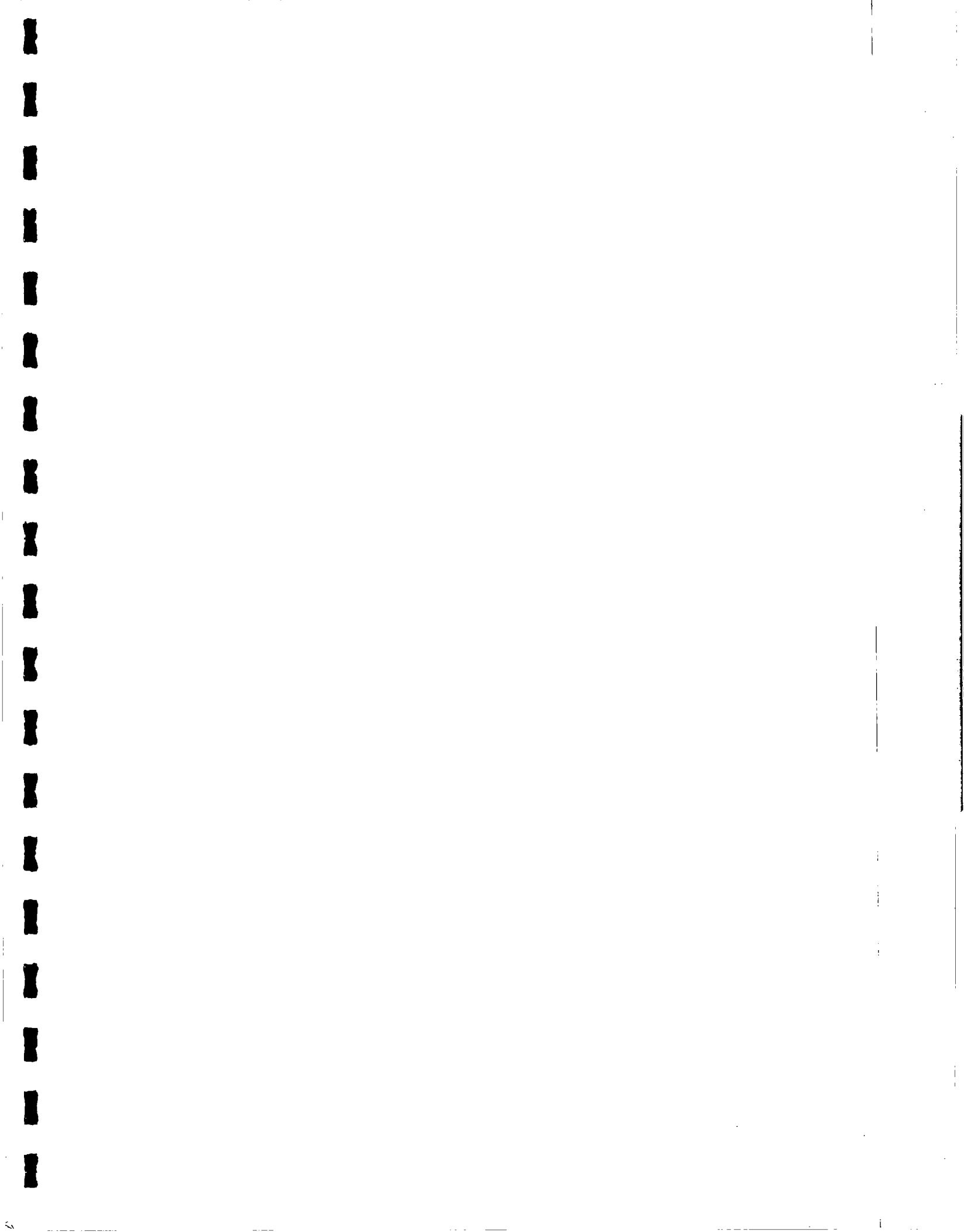




TABLE 1

MONITORING LOCATION COMPLETION DATA  
12th STREET LANDFILL  
OTSEGO, MICHIGAN

	<i>Ground Surface Elevation</i>	<i>Reference Elevation</i>	<i>Well Depth</i>	<i>Screen Length</i>	<i>Depth to Top of Screen</i>	<i>Top of Screen Elevation</i>
	(feet AMSL)	(feet AMSL)	(feet)	(feet)	(feet)	(feet AMSL)
<i>Monitoring Locations</i>						
<i>Groundwater Monitoring Wells</i>						
MW-101S	734.35	737.46	39	7	32	695.35
MW-101D	734.33	737.14	75	5	70	702.35
MW-102S	704.18	707.36	10	7	3	701.18
MW-102D	704.43	707.43	45	5	40	664.43
MW-103D	704.37	707.36	35	5	30	674.37
MW-104S	703.86	706.55	25.5	7	19	685.36
MW-104D	703.48	706.42	45	5	40	663.98
MW-105S	704.89	707.86	12	7	5	699.89
MW-105D	704.79	707.89	47	5	42	662.79
MW-106S	703.89	706.96	9	7	2	701.89
MW-106D	703.66	706.36	45	5	39	664.66
MW-107S	703.76	706.73	13	5	8	695.76
MW-108S	703.32	706.21	9	7	2	701.32
MW-108D	703.39	706.16	45	5	40	663.39
MW-109D	707.41	710.46	23	5	18	689.41
<i>Gas Probes</i>						
GP-1	707.35	709.88	4	2	2	705.35
GP-2	732.88	736.12	32	25	5	727.88
GP-3	703.51	706.47	5	2	2.25	701.01

Notes:

AMSL - Above mean sea level.





TABLE 2

OM&M SCHEDULE  
12th STREET LANDFILL  
OTSEGO, MICHIGAN

Year Event	Year 1				Year 2				Year 3		Year 4		Year 5
	Semiannual Q1	Semiannual Q2	Quarterly Q3	Semiannual Q4	Quarterly Q5	Semiannual Q6	Quarterly Q7	Semiannual Q8	Semiannual	Semiannual	Semiannual	Semiannual	Annual
<i>Monitoring Locations</i>													
<i>Groundwater Monitoring Wells</i>													
<i>Upgradient</i>													
MW-101S	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-101D	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-102S	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-102D	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Downgradient</i>													
MW-103	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-104S	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-104D	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-105S	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-105D	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-106S	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-106D	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-107S	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-108S	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-108D	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-109D	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Gas Probes</i>													
GP-1	X	X	X	X	X	X	X	X	X	X	X	X	X
GP-2	X	X	X	X	X	X	X	X	X	X	X	X	X
GP-3	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Staff Gauge</i>													
SG-101	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Maintenance Locations*</i>													
<i>Inspections</i>													
Landfill Cover	X	X	X	X	X	X	X	X	X	X	X	X	X
Erosion Control System	X	X	X	X	X	X	X	X	X	X	X	X	X
Site Access Controls	X	X	X	X	X	X	X	X	X	X	X	X	X
Gas Vents	X	X	X	X	X	X	X	X	X	X	X	X	X
Gas Probes	X	X	X	X	X	X	X	X	X	X	X	X	X
Groundwater Monitoring Wells	X	X	X	X	X	X	X	X	X	X	X	X	X
Staff Gauge	X	X	X	X	X	X	X	X	X	X	X	X	X

## Notes:

X - Semiannual Monitoring Event per USEPA approval for petition for reduction from Quarterly Monitoring Program.

X - Annual Monitoring Event per USEPA approval for petition for reduction from Semiannual Monitoring Program.

\*- Includes quarterly maintenance and inspection tasks for the Site.

Q1 - Approximately every 3 months/quarterly.







APPENDIX A

REVISIONS TO OPERATIONS, MAINTENANCE, AND MONITORING PLAN

**REVISIONS TO OPERATIONS, MAINTENANCE, AND MONITORING PLAN  
12<sup>th</sup> STREET LANDFILL  
OTSEGO TOWNSHIP, MICHIGAN**

Revision 1      April 18, 2012

Response to USEPA comments March 1, 2012

Revision 2      December 20, 2012

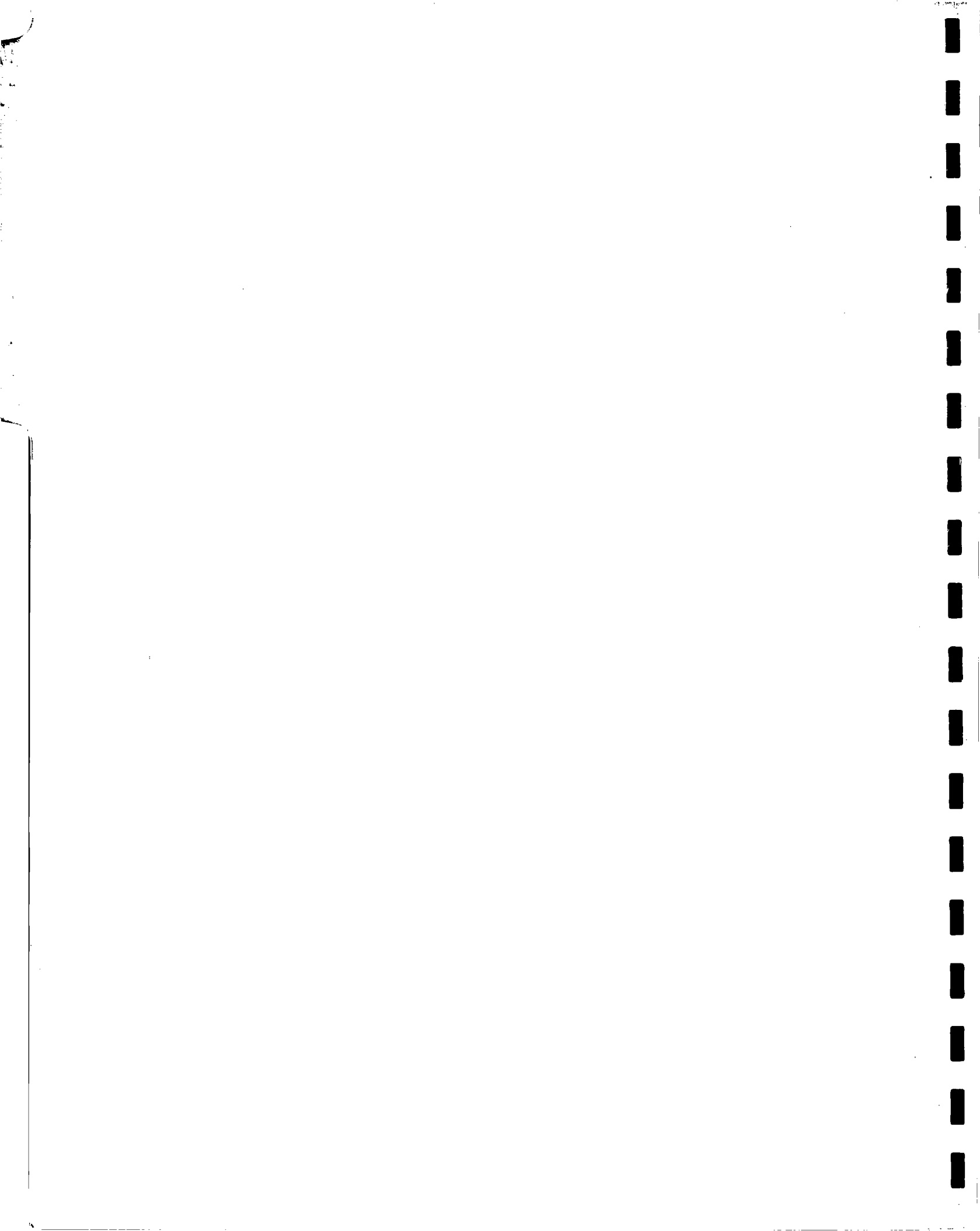
Response to USEPA comments November 30, 2012





APPENDIX B  
REMEDIAL ACTION AS-BUILT DRAWINGS









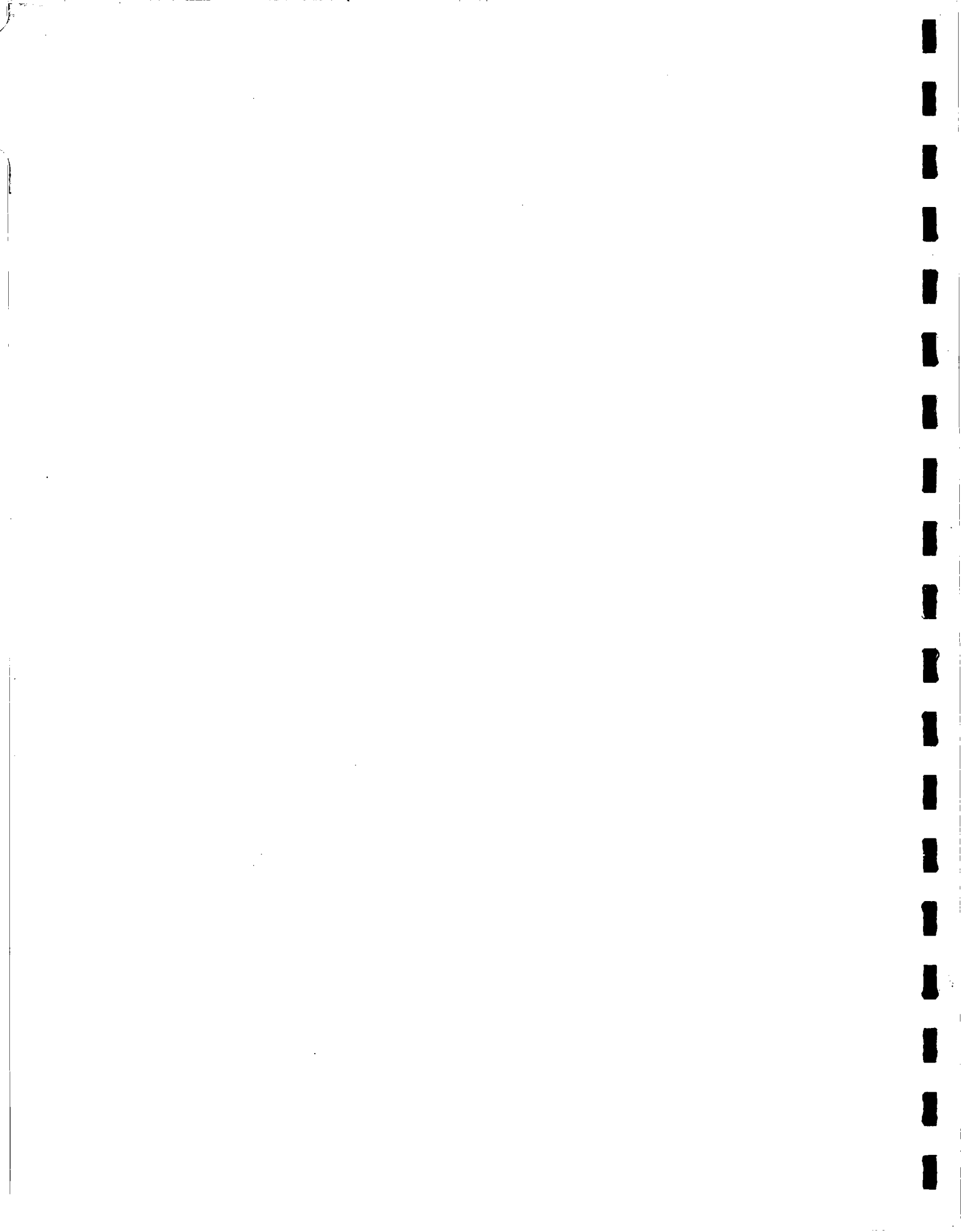










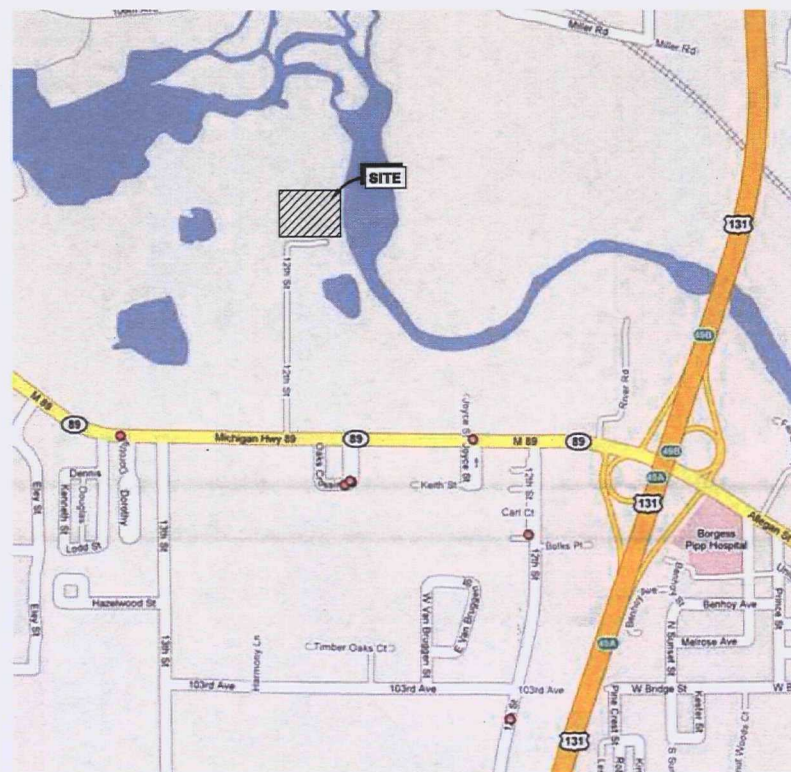












SOURCE: GOOGLE MAPS

**KEY MAP**  
1:1000

**DRAWING INDEX**

DWG. No.	DATE	TITLE
C-01	SEPTEMBER 2012	OVERALL SITE PLAN
C-02	SEPTEMBER 2012	SUBGRADE CONTOURS
C-03	SEPTEMBER 2012	PASSIVE GAS MANAGEMENT SYSTEM
C-04	SEPTEMBER 2012	LINER PLACEMENT
C-05	SEPTEMBER 2012	FINAL CONTOURS
C-06	SEPTEMBER 2012	CROSS SECTIONS I
C-07	SEPTEMBER 2012	CROSS SECTIONS II
C-08	SEPTEMBER 2012	TOE OF SLOPE DETAILS
C-09	SEPTEMBER 2012	EROSION CONTROL MEASURES
C-10	SEPTEMBER 2012	EXCAVATION AREAS
C-11	SEPTEMBER 2012	TYPICAL DETAILS I
C-12	SEPTEMBER 2012	TYPICAL DETAILS II

# AS-BUILT DRAWINGS

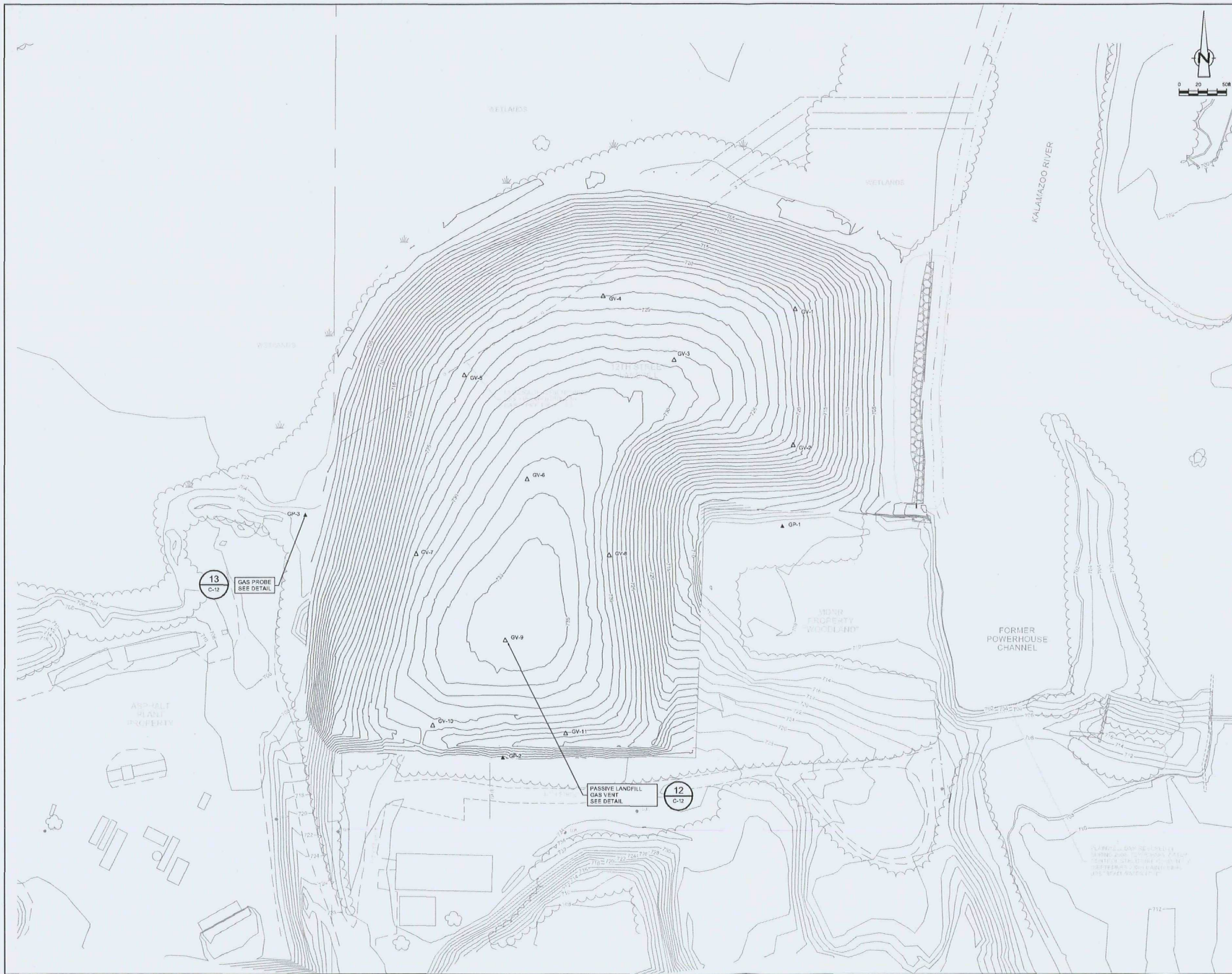
## 12th STREET LANDFILL Otsego Township, Michigan











NO	Revision	Date	Initial

**LEGEND**

- APPROXIMATE PROPERTY BOUNDARY
- == PAVED ROAD
- - - UNPAVED ROAD
- - - FENCE
- ▭ BUILDING
- GROUND ELEVATION CONTOUR
- TREES AND/OR BRUSH
- WET AREA AND WETLAND
- EDGE OF WATER
- SUBGRADE ELEVATION CONTOURS
- △ GV-1 GAS VENT
- ▲ GP-2 GAS PROBE

**SURVEY DATA:**

1. EXCAVATION AREAS 1-6: FIELD DATE 8/1/10; AREAS 8-9: FIELD DATE 7/1/10; AREA 10: FIELD DATE 7/27/10; OVERALL RANGE OF DATES 6/1 - 7/27, 2010.
2. EXCAVATION AREAS 11-12: FIELD DATE 7/27/10; AREA 13: FIELD DATE 8/1/10; AREA 14 (MAJOR PORTION IN FRONT OF ASPHALT PLANT OFFICE): FIELD DATE 8/24/10; OVERALL RANGE OF DATES 7/27 - 8/24, 2010.
3. EXCAVATION AREA 7: FIELD DATE 7/1/10; WASH OUT AREA: FIELD DATE 7/30/10; OVERALL RANGE OF DATES 7/1 - 7/30, 2010.
4. ASPHALT PLANT WINTER EXCAVATION: OVERALL RANGE OF DATES 12/20/2010 - 1/18/2011.
5. FINAL CONTOUR SURVEY: OVERALL RANGE OF DATES 12/17/2010 - 4/15/2011, THAT INCLUDES ALL GROUND SURFACE SHOTS TOGETHER WITH MONITOR WELLS, GAS VENTS, STRAW MAT, ROCK, AND FENCE.
6. SUB-GRADE SURVEY: 9/1/2011

**SCALE VERIFICATION**

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved:

**DRAWING STATUS**

Status	Date	Initial
RE-ISSUED FOR EPA SUBMISSION	SEPT. 15, 2012	CRH
RE-ISSUED FOR EPA SUBMISSION	JUNE 5, 2012	CRH
ISSUED FOR EPA SUBMISSION	DEC. 23, 2011	CRH

**12th STREET LANDFILL**  
Otsego Township, Michigan

**AS-BUILT DRAWINGS**

**PASSIVE GAS MANAGEMENT SYSTEM**

**CRA ENGINEERING INC.**

**Source Reference:**

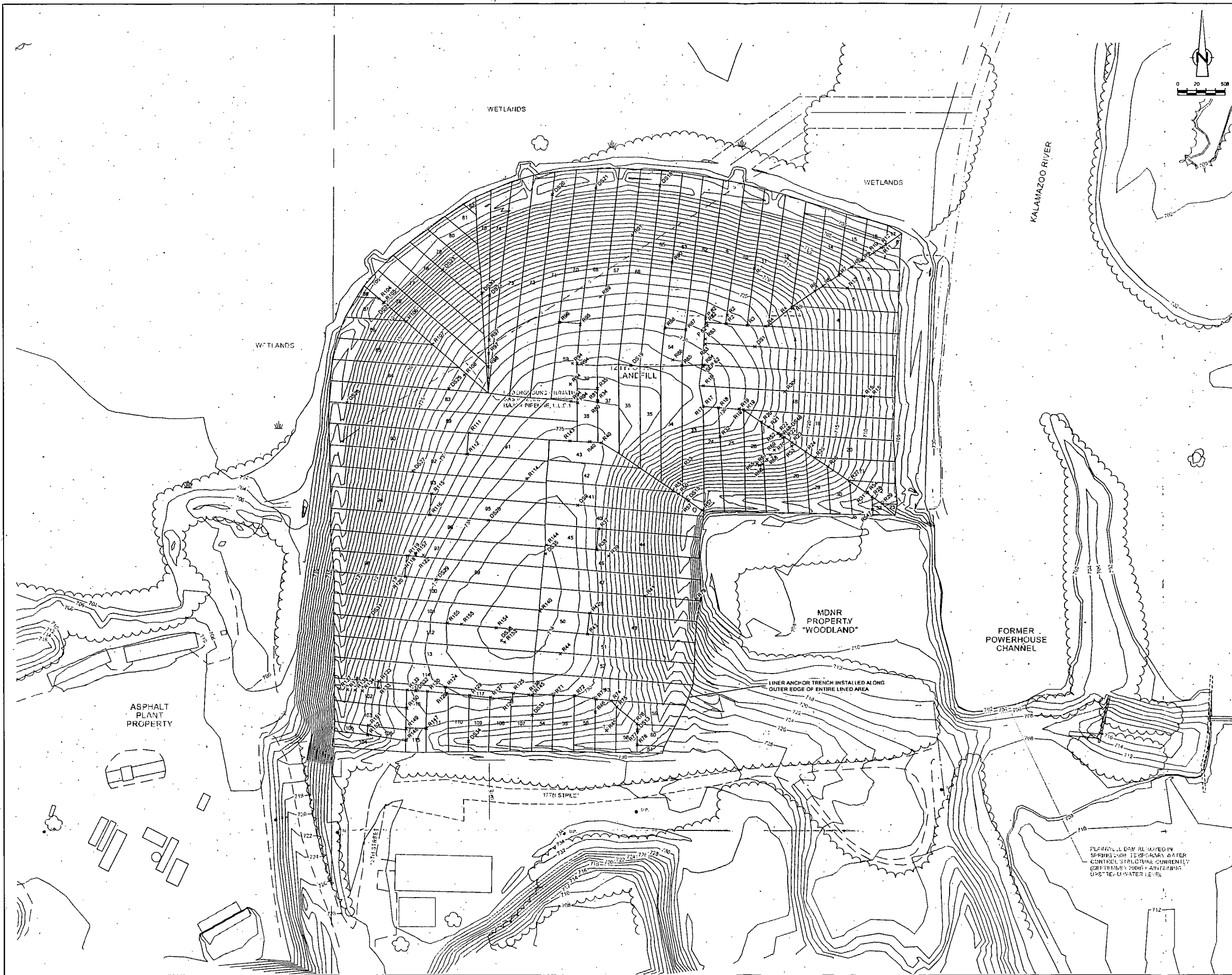
BASE ADAPTED FROM PREVIOUS RMT DESIGN

Project Manager:	Reviewed By:	Date:
G. CARLI	R. HOEKSTRA	DECEMBER 2011

Scale:	Project N°:	Report N°:	Drawing N°:
1" = 50'-0"	56393-07	008	C-03

56393-07(008)CI-WA003 SEP 10/2012





NO	Revision	Date	Initial

**LEGEND**

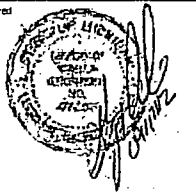
- APPROXIMATE PROPERTY BOUNDARY
- == PAVED ROAD
- - - UNPAVED ROAD
- - - FENCE
- ▭ BUILDING
- 700 GROUND ELEVATION CONTOUR
- TREES AND/OR BRUSH
- WET AREA AND WETLAND
- EDGE OF WATER
- 718 FINAL ELEVATION CONTOURS
- + R-1 REPAIR LOCATION
- + DS1 DESTRUCT LOCATION

**SURVEY DATA:**

1. EXCAVATION AREAS 1-6: FIELD DATE 9/1/10; AREAS 8-9: FIELD DATE 7/1/10; AREA 10: FIELD DATE 7/27/10; OVERALL RANGE OF DATES 8/1 - 7/27, 2010.
2. EXCAVATION AREAS 11, 12: FIELD DATE 7/27/10; AREA 13: FIELD DATE 8/1/10; AREA 14 (MAJOR PORTION IN FRONT OF ASPHALT PLANT OFFICES): FIELD DATE 8/24/10; OVERALL RANGE OF DATES 7/27 - 8/24, 2010.
3. EXCAVATION AREA 7: FIELD DATE 7/1/10; WASH OUT AREA: FIELD DATE 7/30/10; OVERALL RANGE OF DATES 7/1 - 7/30, 2010.
4. ASPHALT PLANT WINTER EXCAVATION: OVERALL RANGE OF DATES 12/20/2010 - 1/18/2011.
5. FINAL CONTOUR SURVEY: OVERALL RANGE OF DATES 12/17/2010 - 4/15/2011, THAT INCLUDES ALL GROUND SURFACE SHOTS TOGETHER WITH MONITOR WELLS, GAS VENTS, STRAW MAT, ROCK, AND FENCE.
6. SUB-GRADE SURVEY: 9/1/2011

**SCALE VERIFICATION**

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved: 


**DRAWING STATUS**

RE-ISSUED FOR EPA SUBMISSION	SEPT. 15, 2012	CRH
RE-ISSUED FOR EPA SUBMISSION	JUNE 5, 2012	CRH
ISSUED FOR EPA SUBMISSION	DEC. 23, 2011	CRH
Scale	Date	Initial

**12th STREET LANDFILL**  
Otsego Township, Michigan

**AS-BUILT DRAWINGS**

**LINER PLACEMENT**

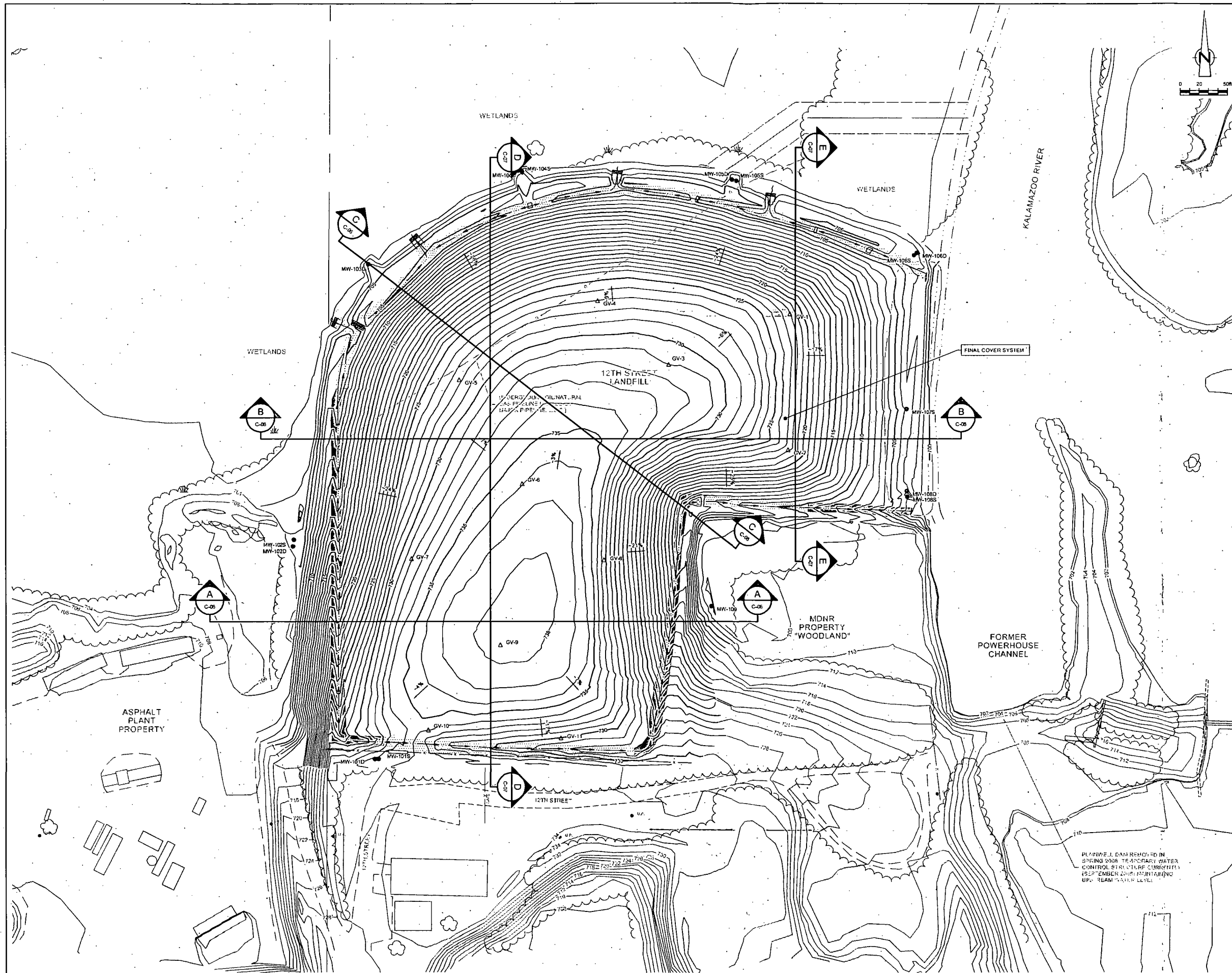
 **CRA ENGINEERING INC.**

Source Reference: BASE ADAPTED FROM PREVIOUS RMT DESIGN

Project Manager:	Reviewed By:	Date:
G. CARLI	R. HOEKSTRA	DECEMBER 2011

Scale:	Project N°:	Report N°:	Drawing N°:
1" = 50'-0"	56393-07	008	C-04

56393-07(008)C1-WA004 SEP 10/2012



NO	Revision	Date	Initial

LEGEND	
	APPROXIMATE PROPERTY BOUNDARY
	PAVED ROAD
	UNPAVED ROAD
	FENCE
	BUILDING
	GROUND ELEVATION CONTOUR
	TREES AND/OR BRUSH
	WET AREA AND WETLAND
	EDGE OF WATER
	FINAL ELEVATION CONTOURS
	ROAD/ DRAINAGE SWALE w/ TURF REINFORCEMENT MAT
	ROAD/ DRAINAGE SWALE STABILIZED WITH GEOWEB
	MW-102B MONITORING WELL
	GV-1 GAS VENT
	GP-2 GAS PROBE

**SURVEY DATA:**  
1. EXCAVATION: AREAS 1-5: FIELD DATE 8/1/10; AREAS 8-9: FIELD DATE 7/1/10; AREA 10: FIELD DATE 7/27/10; OVERALL RANGE OF DATES 6/1 - 7/27, 2010.  
2. EXCAVATION: AREAS 11, 12: FIELD DATE 7/27/10; AREA 13: FIELD DATE 9/11/10; AREA 14 (MAJOR PORTION IN FRONT OF ASPHALT PLANT OFFICE): FIELD DATE 8/24/10; OVERALL RANGE OF DATES 7/27 - 8/24, 2010.  
3. EXCAVATION: AREA 7: FIELD DATE 7/1/10; WASH OUT AREA: FIELD DATE 7/30/10; OVERALL RANGE OF DATES 7/1 - 7/30, 2010.  
4. ASPHALT PLANT WINTER EXCAVATION: OVERALL RANGE OF DATES 12/20/2010 - 1/18/2011.  
5. FINAL CONTOUR SURVEY: OVERALL RANGE OF DATES 12/17/2010 - 4/15/2011, THAT INCLUDES ALL GROUND SURFACE SHOTS TOGETHER WITH MONITOR WELLS, GAS VENTS, STRAW MAT, ROCK, AND FENCE.  
6. SUB-GRADE SURVEY: 9/1/2011.

**SCALE VERIFICATION**  
THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved:

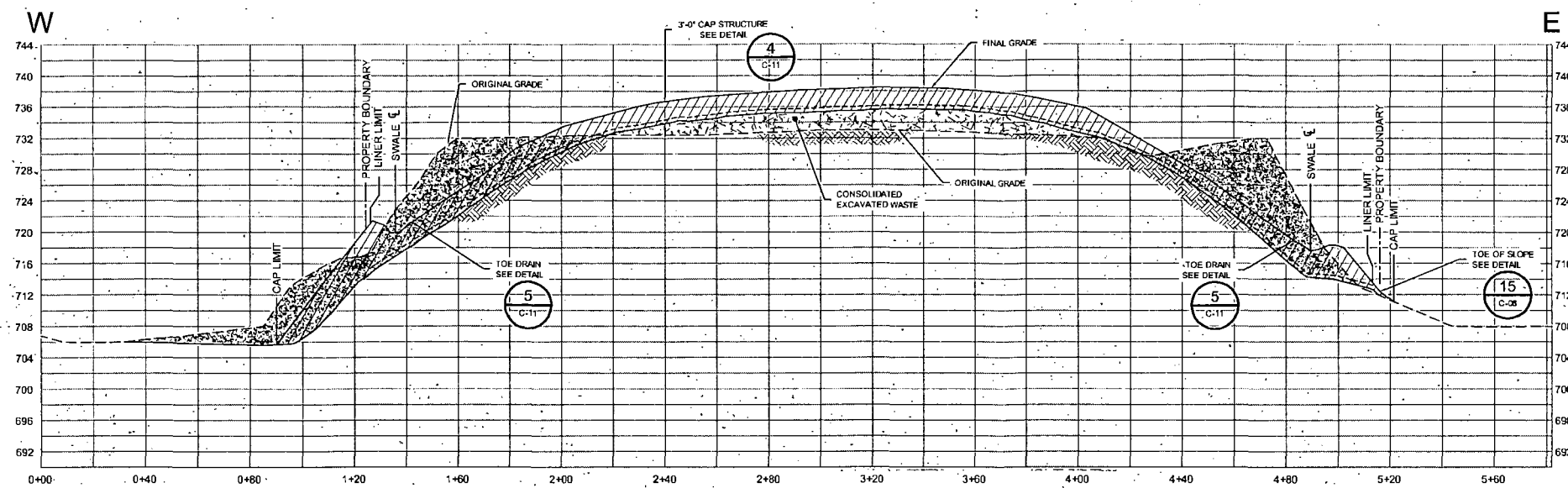
DRAWING STATUS		
RE-ISSUED FOR EPA SUBMISSION	SEPT. 15, 2012	CRH
RE-ISSUED FOR EPA SUBMISSION	JUNE 5, 2012	CRH
ISSUED FOR EPA SUBMISSION	DEC. 23, 2011	CRH
Status	Date	Initial

**12th STREET LANDFILL**  
Otsego Township, Michigan

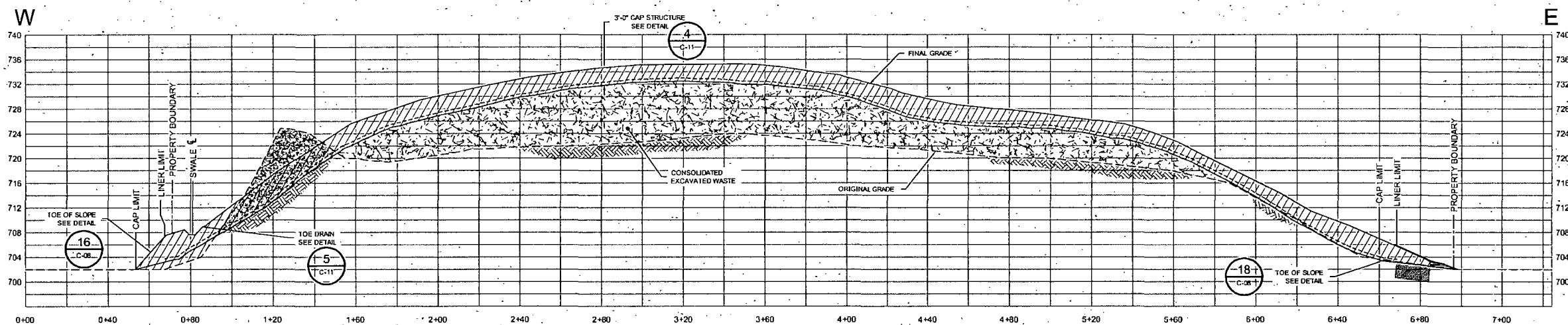
**AS-BUILT DRAWINGS**

**FINAL CONTOURS**  
**AND CROSS-SECTION LOCATIONS**

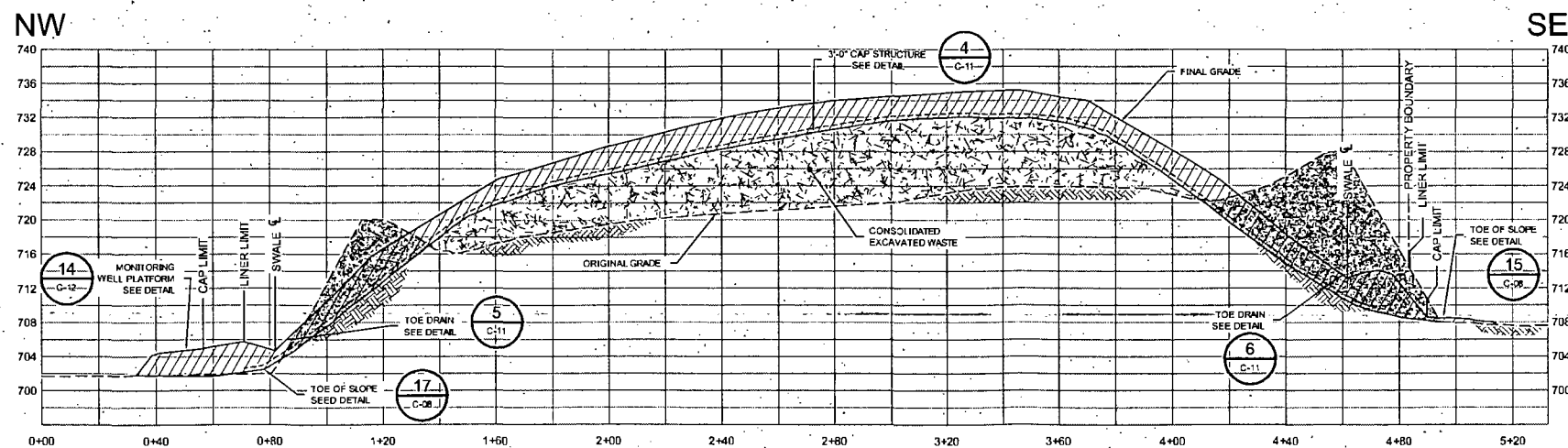
CRA ENGINEERING INC.			
Source Reference:			
BASE ADAPTED FROM PREVIOUS RMT DESIGN			
Project Manager:	Reviewed By:	Date:	
G. CARLI	R. HOEKSTRA	DECEMBER 2011	
Scale:	Project N°:	Report N°:	Drawing N°:
1" = 50'-0"	56393-07	008	C-05



SECTION A  
HORZ: 1"=30'  
VERT: 1"=10'



SECTION B  
HORZ: 1"=30'  
VERT: 1"=10'

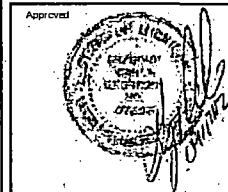


SECTION C  
HORZ: 1"=30'  
VERT: 1"=10'

NO	Revision	Date	Initial

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.



DRAWING STATUS

RE-ISSUED FOR EPA SUBMISSION	SEPT. 15, 2012	CRH
Status	Date	Initial

12th STREET LANDFILL  
Otsego Township, Michigan.

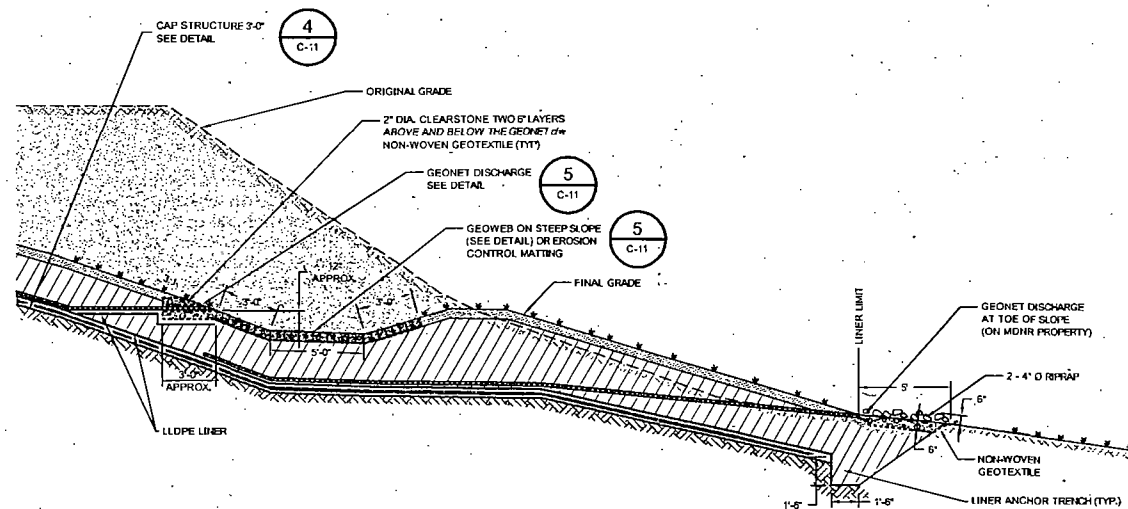
AS-BUILT DRAWINGS

CROSS  
SECTIONS I

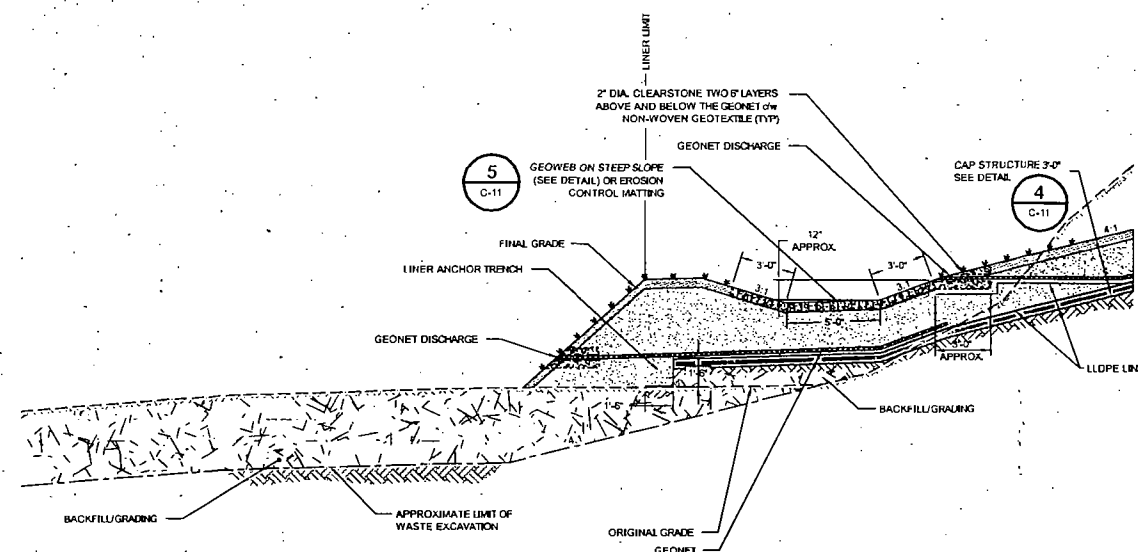


Project Manager: G. CARL	Reviewed By: R. HOKSTRA	Date: SEPTEMBER 2012
Scale: 1" = 50'-0"	Project N°: 56393-07	Report N°: 008
		Drawing N°: C-06

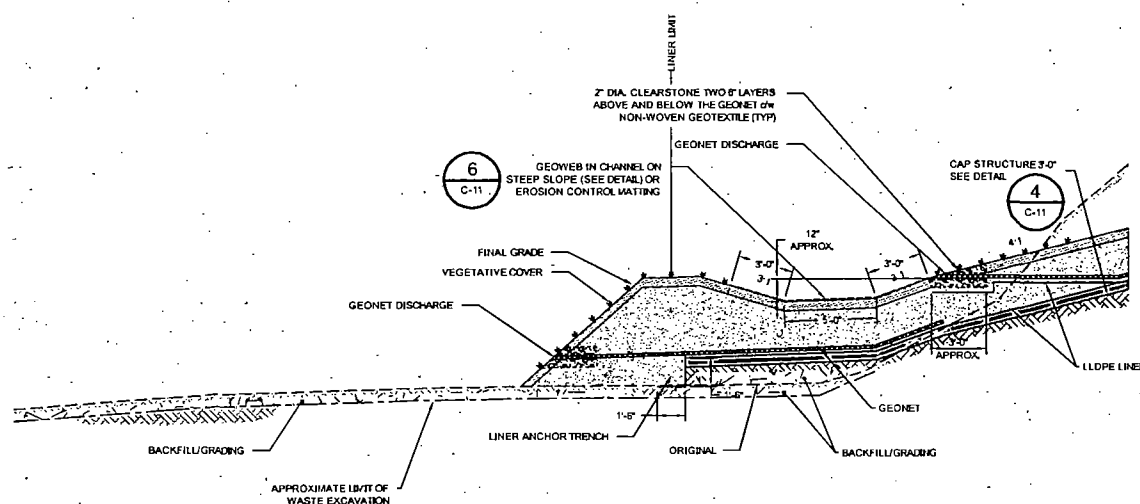




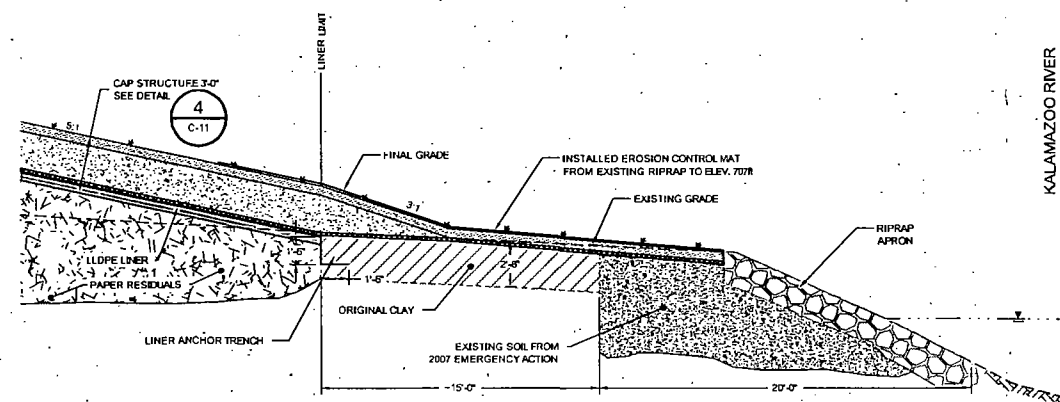
DETAIL 15 TYPICAL TOE OF SLOPE - MDNR PROPERTY  
N.T.S. C-05, C-07



DETAIL 16 TYPICAL TOE OF SLOPE - ASPHALT PLANT PROPERTY  
N.T.S. C-06



SECTION 17 TYPICAL TOE OF SLOPE - NORTH WETLAND  
N.T.S. C-06, C-07



DETAIL 18 TYPICAL TOE OF SLOPE - KALAMAZOO RIVER  
N.T.S. C-06

NO	Revision	Date	Initial

SCALE VERIFICATION	
THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.	

Approved	

DRAWING STATUS		

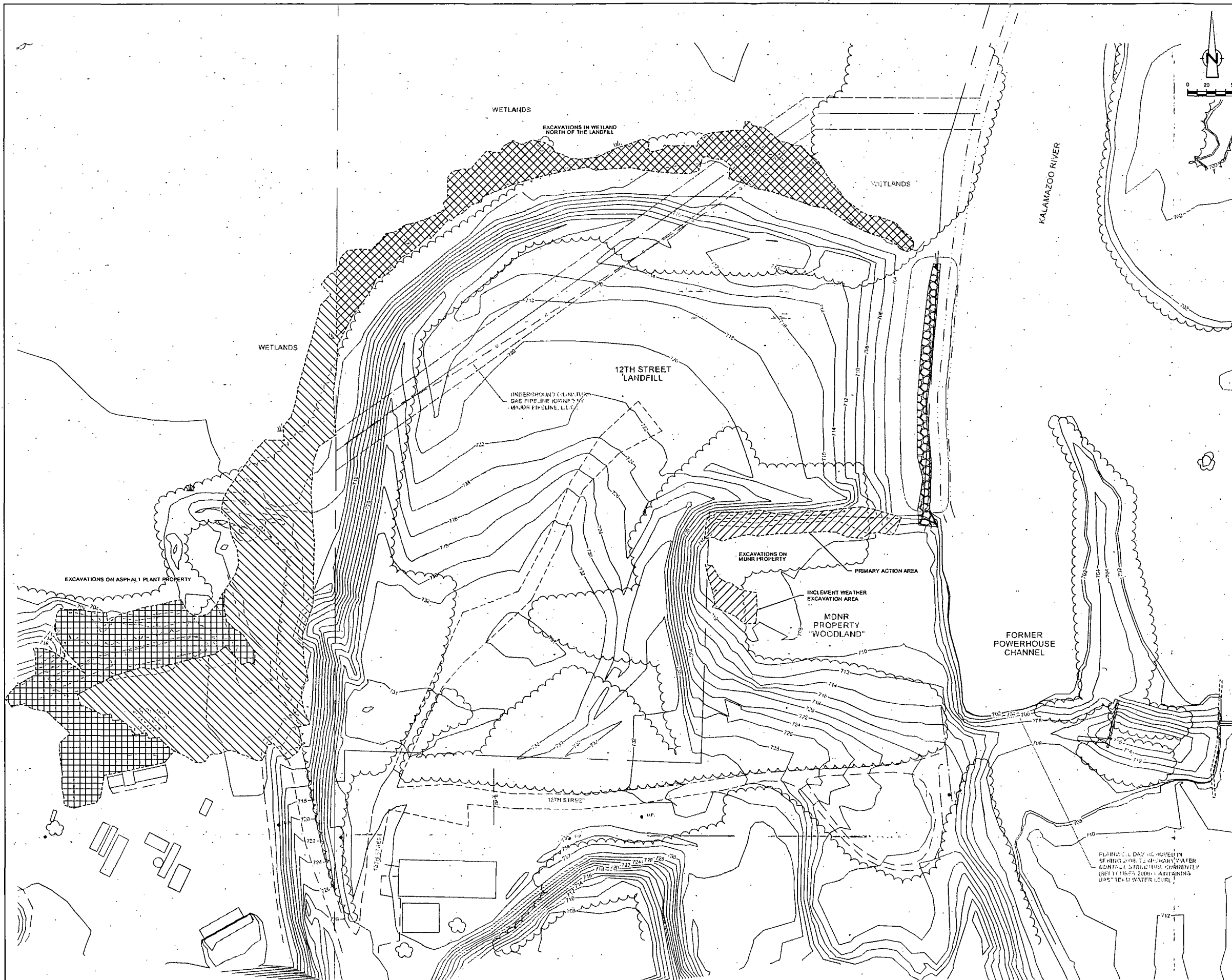
12th STREET LANDFILL Otsego Township, Michigan		
AS-BUILT DRAWINGS		
TOE OF SLOPE DETAILS		

Source Reference:			
Project Manager:	Reviewed By:	Date:	
G. CARLI	R. HOEKSTRA	SEPTEMBER 2012	
Scale:	Project N°:	Report N°:	Drawing N°:
1" = 50'-0"	56393-07	008	C-08









NO	Revision	Date	Initial

**LEGEND**

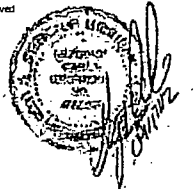
- APPROXIMATE PROPERTY BOUNDARY
- == PAVED ROAD
- - - UNPAVED ROAD
- - - FENCE
- ▭ BUILDING
- 700 GROUND ELEVATION CONTOUR
- TREES AND/OR BRUSH
- WET AREA AND WETLAND
- EDGE OF WATER
- ▨ LIMIT OF ACTUAL EXCAVATION (MDNR PROPERTY)
- ▩ LIMIT OF ACTUAL EXCAVATION (WETLAND NORTH OF LANDFILL)
- ▧ LIMIT OF ACTUAL EXCAVATION (ASPHALT PLANT PROPERTY - AUGUST 2010)
- ▦ LIMIT OF ACTUAL EXCAVATION (ASPHALT PLANT PROPERTY - JANUARY 2011)

**SURVEY DATA:**

1. EXCAVATION: AREAS 1-6: FIELD DATE 6/1/10; AREAS 8-9: FIELD DATE 7/1/10; AREA 10: FIELD DATE 7/27/10; OVERALL RANGE OF DATES 6/1 - 7/27, 2010.
2. EXCAVATION: AREAS 11, 12: FIELD DATE 7/27/10; AREA 13: FIELD DATE 8/11/10; AREA 14 (MAJOR PORTION IN FRONT OF ASPHALT PLANT OFFICE): FIELD DATE 8/24/10; OVERALL RANGE OF DATES 7/27 - 8/24, 2010.
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4. ASPHALT PLANT WINTER EXCAVATION: OVERALL RANGE OF DATES 12/20/2010 - 1/18/2011.
5. FINAL CONTOUR SURVEY: OVERALL RANGE OF DATES 12/17/2010 - 4/15/2011, THAT INCLUDES ALL GROUND SURFACE SHOTS TOGETHER WITH MONITOR WELLS, GAS VENTS, STRAW MAT, ROCK, AND FENCE.
6. SUB-GRADE SURVEY: 9/1/2011.

**SCALE VERIFICATION**

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved: 


**DRAWING STATUS**

RE-ISSUED FOR EPA SUBMISSION	DATE	BY
RE-ISSUED FOR EPA SUBMISSION	SEPT. 15, 2012	CRH
RE-ISSUED FOR EPA SUBMISSION	JUNE 5, 2012	CRH
ISSUED FOR EPA SUBMISSION	DEC. 23, 2011	CRH

12th STREET LANDFILL  
Otsego Township, Michigan

AS-BUILT DRAWINGS

EXCAVATION  
AREAS

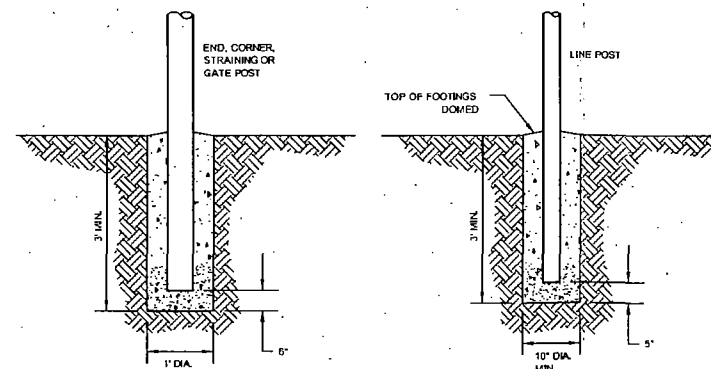
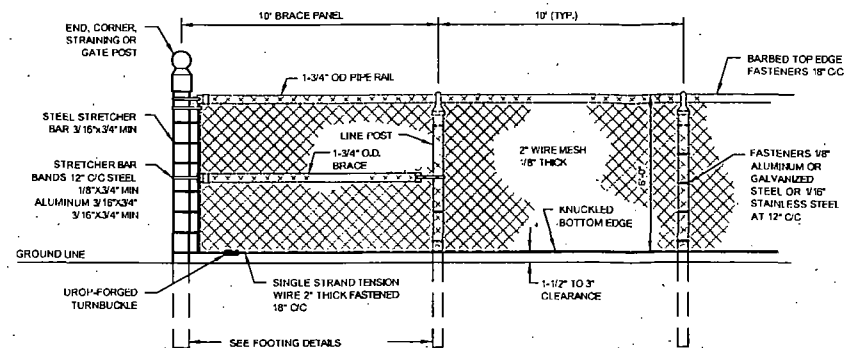
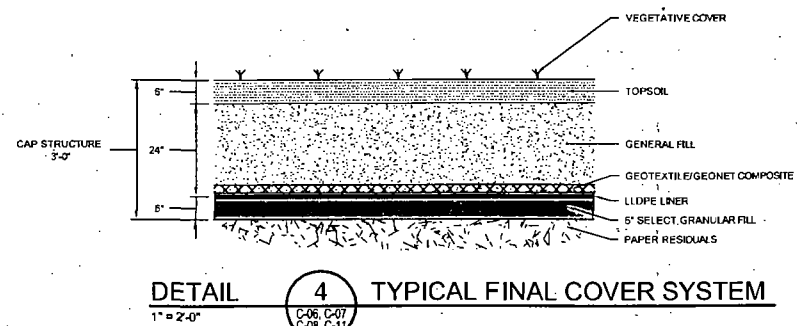
 **CRA ENGINEERING INC.**

Source Reference:  
BASE ADAPTED FROM PREVIOUS RMT DESIGN

Project Manager:	Reviewed By:	Date:
G. CARLI	R. HOEKSTRA	DECEMBER 2011

Scale:	Project N°:	Report N°:	Drawing N°:
1" = 50'-0"	56393-07	008	C-10

56393-07(008)C1-WA007 SEP 10/2012

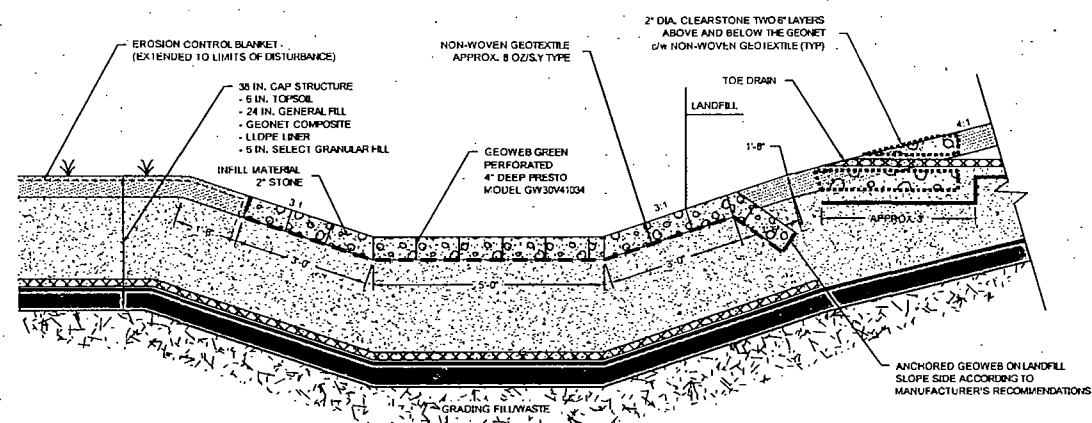


**POST AND RAIL SIZES - FENCE**

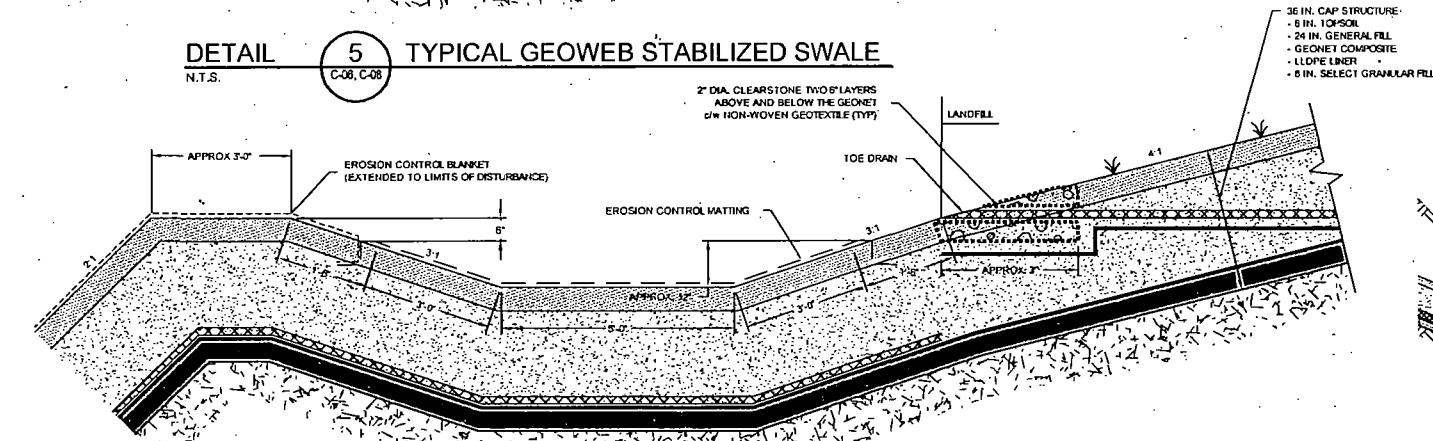
USE	FABRIC HEIGHT	O.D.	LBS/FT
INTERMEDIATE POSTS	BELOW 9'	2-3/8"	3.55
CORNER, END, GATE AND BRACE POSTS	BELOW 9'	2-7/8"	5.79
RAILS	ALL	1-5/8"	2.27

CARBON STEEL PIPE - ASTM A-20, SCH 40

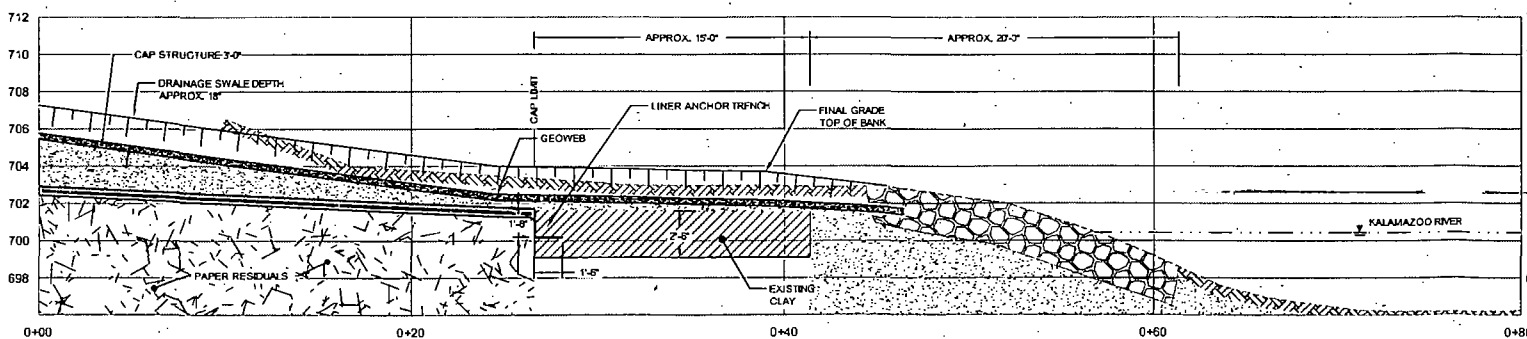
**DETAIL 8 TYPICAL SITE FENCING**  
N.T.S.



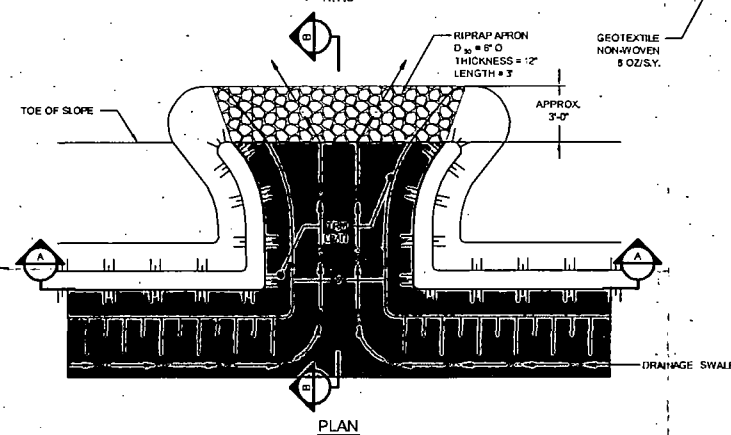
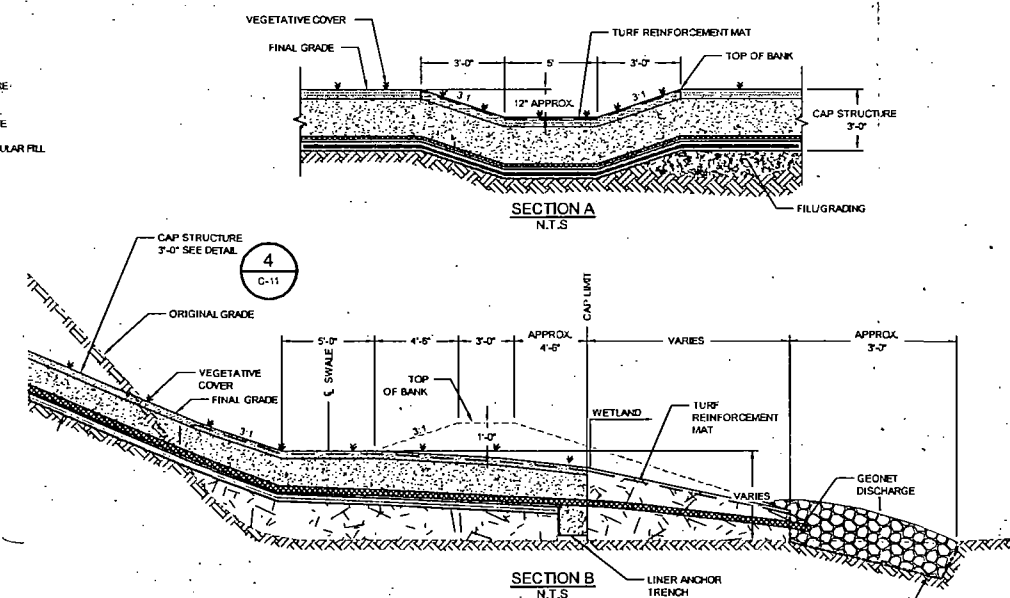
**DETAIL 5 TYPICAL GEOWEB STABILIZED SWALE**  
N.T.S.



**DETAIL 6 TYPICAL TURF REINFORCEMENT MAT STABILIZED SWALE**  
N.T.S.



**DETAIL 7 TYPICAL DRAINAGE SWALE TO KALAMAZOO RIVER DISCHARGE**  
1" = 5'-0"



**DETAIL 9 TYPICAL DRAINAGE OUTLET**  
N.T.S.

NO.	Revision	Date	Initial

**SCALE VERIFICATION**  
THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved:

**DRAWING STATUS**

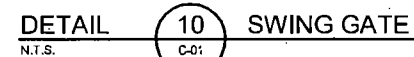
RE-ISSUED FOR EPA SUBMISSION	SEPT. 15, 2012	CRH
Status	Date	Initial

**12th STREET LANDFILL**  
Otsego Township, Michigan  
AS-BUILT DRAWINGS  
TYPICAL DETAILS I

**CRA ENGINEERING INC.**

Source Reference:

Project Manager:	Reviewed By:	Date:
G. CARLI	R. HOEKSTRA	SEPTEMBER 2012
Scale:	Project N°:	Report N°:
1" = 50'-0"	56393-07	008
		C-11

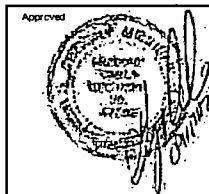


MONITORING LOCATIONS	GROUND SURFACE ELEVATION (FEET AMSL)	SCREEN DEPTH (FEET)	HORIZONTAL SCREEN LENGTH (FEET)	TOP OF VENT ELEVATION (FEET AMSL)
GAS VENTS				1
GV-1	722.12	5	16	728.45
GV-2	722.09	5	16	728.43
GV-3	731.04	0	16	737.37
GV-4	727.05	8	16	733.38
GV-5	727.16	5	16	734.07
GV-6	733.97	5	16	742.32
GV-7	731.80	5	16	738.72
GV-8	732.44	5	16	738.77
GV-9	738.35	8	16	744.99
GV-10	733.99	5	16	740.33
GV-11	738.53	5	16	738.38

[illegible]

### SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.



### DRAWING STATUS

RE-ISSUED FOR EPA SUBMISSION	SEPT. 15, 2012	CRH
Status	Date	Initial

12th STREET LANDFILL  
Otsego Township, Michigan

AS-BUILT DRAWINGS

## TYPICAL DETAILS II



**CRA ENGINEERING INC.**

Source References:

Project Manager: G. CARLI	Reviewed By: R. HOEKSTRA	Date: SEPTEMBER 2012	
Scale: 1" = 50'-0"	Project N°: 56393-07	Report N°: 008	Drawing N°: C-12

56303-37(008)CLWA010 SEP 10 20:2



APPENDIX C

STRATIGRAPHY AND MONITORING WELL/GAS PROBE CONSTRUCTION LOGS



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-101S  
DATE COMPLETED: February 1, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	"N" VALUE	
	NORTHING: 351038.12 EASTING: 12771358.94	TOP OF CASING 737.46 GROUND SURFACE 734.35						
2	SM-SILTY SAND (FILL), loose, fine grained, poorly graded, yellowish brown, damp - trace fine grained subangular gravel at 0.3ft BGS	733.35 733.05	CONCRETE					
4	SM-SILTY SAND (TOPSOIL), trace roots, compact, brown, damp		BENTONITE GROUT					
6	SM-SILTY SAND (natural), trace fine to coarse grained, gravel, trace roots, compact, fine grained, poorly graded, yellowish brown, damp	728.85	2" PVC WELL CASING					
8	SP-SAND, trace fine grained subrounded gravel, trace silt, compact, medium grained, trace coarse grained sand, poorly graded, yellowish brown, damp		8" BOREHOLE					
10	- fine grained sand, with fine grained gravel at 10.5ft BGS							
12	- medium grained sand, with fine grained gravel at 12.5ft BGS							
14								
16								
18	- moist at 17.0ft BGS - trace coarse grained subrounded gravel at 17.5ft BGS - 3" lens highly oxidized at 18.5ft BGS							
20								
22	- 6" lens sandy gravel at 21.5ft BGS							
24								
26	- occasional lenses sand, fine grained gravel at 26.0ft BGS - occasional oxidized lenses, moist to very moist at 26.5ft BGS							
28								
30			BENTONITE CHIPS					
32	GP-SANDY GRAVEL, compact, medium grained sand, fine grained rounded gravel, poorly graded, brown, very moist - wet at 33.5ft BGS	702.35	2" PVC WELL SCREEN					
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA CORP GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 2 of 2

PROJECT NAME: 12TH ST LANDFILL

PROJECT NUMBER: 056393

CLIENT: WEYERHAEUSER COMPANY


LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-101S

DATE COMPLETED: February 1, 2011

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE			
				NUMBER	INTERVAL	REC (%)	'N' VALUE
36	- 5' no recovery, coarse gravel in shoe of sampler at 35.0ft BGS		 SAND PACK				
38							
40	END OF BOREHOLE @ 39.0ft BGS	695.35	<b>WELL DETAILS</b> Screened interval: 702.35 to 695.35ft 32.00 to 39.00ft BGS Length: 7ft Diameter: 2in Slot Size: 0.010 Material: PVC Seal: 705.35 to 703.35ft 29.00 to 31.00ft BGS Material: BENTONITE CHIPS Sand Pack: 703.35 to 695.35ft 31.00 to 39.00ft BGS Material: #4 SAND				
42							
44							
46							
48							
50							
52							
54							
56							
58							
60							
62							
64							
66							
68							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 3

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-101D  
DATE COMPLETED: February 1, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	N' VALUE	
	NORTHING: 351037.94 EASTING: 12771354.87  TOP OF CASING GROUND SURFACE	737.14 734.33						
2	SM-SILTY SAND (FILL), loose, fine grained, poorly graded, yellowish brown, damp - trace fine grained subangular gravel at 0.3ft BGS	733.33 733.03	CONCRETE	1MC		50		
4	SM-SILTY SAND (TOPSOIL), trace roots, compact, brown, damp		BENTONITE GROUT					
6	SM-SILTY SAND (natural), trace fine to coarse grained, gravel, trace roots, compact, fine grained, poorly graded, yellowish brown, damp	728.83	2" PVC WELL CASING					
8	SP-SAND, trace fine grained subrounded gravel, trace silt, compact, medium grained, trace coarse grained sand, poorly graded, yellowish brown, damp		8" BOREHOLE	2MC		50		
10	- fine grained sand, with fine grained gravel at 10.5ft BGS							
12	- medium grained sand, with fine grained gravel at 12.5ft BGS			3MC		80		
14								
16								
18	- moist at 17.0ft BGS - trace coarse grained subrounded gravel at 17.5ft BGS - 3" lens highly oxidized at 18.5ft BGS			4MC		80		
20								
22	- 6" lens sandy gravel at 21.5ft BGS			5MC		80		
24								
26	- occasional lenses sand, fine grained gravel at 26.0ft BGS - occasional oxidized lenses, moist to very moist at 26.5ft BGS			6MC		80		
28								
30								
32	GP-SANDY GRAVEL, compact, medium grained sand, fine grained rounded gravel, poorly graded, brown, very moist - wet at 33.5ft BGS	702.33		7MC		50		
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11





# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 2 of 3

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-101D  
DATE COMPLETED: February 1, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE			
				NUMBER	INTERVAL	REC (%)	'N' VALUE
36	- 5' no recovery, coarse gravel in shoe of sampler at 35.0ft BGS	688.33		8MC		0	
38							
40	- poor recovery, coarse grained gravel in shoe of sampler at 40.0ft BGS						
42				39-44' -010		20	
44				9MC			
46	- poor recovery at 45.0ft BGS						
48	SP-SAND, trace coarse grained gravel, compact, medium grained, poorly graded, brown, wet			44-49' -003		20	
50				10MC			
52							
54				49-54' -009		10	
56	- coarse sand, with fine grained gravel at 55.0ft BGS			11MC			
58	- 6" lens coarse sandy gravel at 58.0ft BGS						
60				54-59' -007		60	
62				12MC			
64							
66	- medium grained sand, with fine grained gravel at 65.0ft BGS			59-64' -006		10	
68				13MC			
				64-69' -002		60	
				14MC			

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11

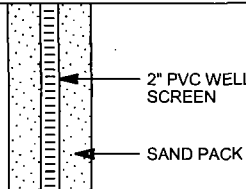


# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 3 of 3

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-101D  
DATE COMPLETED: February 1, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	
72	- 5' no recovery at 70.0ft BGS		 2" PVC WELL SCREEN SAND PACK	29-74 -001 15MC		0		
74								
76	END OF BOREHOLE @ 75.0ft BGS	659.33	<b>WELL DETAILS</b> Screened interval: 664.33 to 659.33ft 70.00 to 75.00ft BGS Length: 5ft Diameter: 2in Slot Size: 0.010 Material: PVC Seal: 667.33 to 665.33ft 67.00 to 69.00ft BGS Material: BENTONITE CHIPS Sand Pack: 665.33 to 659.33ft 69.00 to 75.00ft BGS Material: #1 SAND					
78								
80								
82								
84								
86								
88								
90								
92								
94								
96								
98								
100								
102								
104								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: 12TH ST LANDFILL

PROJECT NUMBER: 056393

CLIENT: WEYERHAEUSER COMPANY

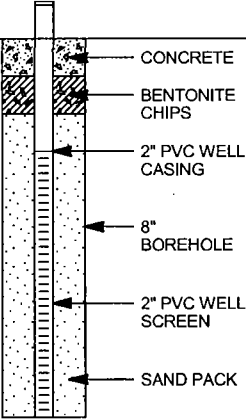
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-102S

DATE COMPLETED: January 27, 2011

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE			
				NUMBER	INTERVAL	REC (%)	N' VALUE
	NORTHING: 351269.65 EASTING: 12771270.16	TOP OF CASING GROUND SURFACE 707.36 704.18					
2	SM/ML-SAND AND SILT (FILL), trace fine grained gravel, compact, fine grained, no plasticity, brown, moist						
4	- loose, wet at 4.8ft BGS						
6							
8	SM/ML-SANDY SILT (natural), compact, fine grained sand, no plasticity, gray with olive gray lenses, wet	696.18 695.68 695.18					
10	- 1" lens medium grained sand, brown at 8.7ft BGS	694.18					
12	SM-SILTY SAND, compact, fine grained, poorly graded, gray, wet						
14	SM/GM-SAND AND GRAVEL, with silt, compact, fine to medium grained sand, fine grained gravel, well graded, yellowish brown, wet						
16	END OF BOREHOLE @ 10.0ft BGS						
18							
20							
22							
24							
26							
28							
30							
32							
34							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-102D  
DATE COMPLETED: January 27, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	"N" VALUE	PID (ppm)
	NORTHING: 351262.51 EASTING: 12771269.21	TOP OF CASING 707.43 GROUND SURFACE 704.43						
2	SM/ML-SAND AND SILT (FILL), trace fine grained gravel, compact, fine grained, no plasticity, brown, moist		CONCRETE					
4	- loose, wet at 4.8ft BGS		BENTONITE GROUT	1MC		60		0.0
6			2" PVC WELL CASING					
8			8" BOREHOLE	2MC 5-10' -107		80		0.0
10	SM/ML-SANDY SILT (natural), compact, fine grained sand, no plasticity, gray with olive gray lenses, wet - 1" lens medium grained sand, brown at 8.7ft BGS	696.43 695.93 695.43						
12	SM-SILTY SAND, compact, fine grained, poorly graded, gray, wet			3MC 10-15' -105		0		0.0
14	SM/GM-SAND AND GRAVEL, with silt, compact, fine to medium grained sand, fine grained gravel, well graded, yellowish brown, wet							
16	- medium to coarse grained sand with fine grained gravel at 13.0ft BGS	689.43		4MC 15-20' -106		60		0.0
18	SP-SAND, with gravel, compact, fine grained sand, poorly graded, brown, wet - 3' sand, coarse grained gravel at 15.8ft BGS - medium grained sand, trace fine grained gravel at 16.1ft BGS							
20	- 1.5" silty clay at 19.7ft BGS			5MC 20-25' -104		60		0.0
22	- medium to coarse grained sand at 22.8ft BGS							
24	GP-GRAVEL, with sand, compact, fine to coarse grained gravel, poorly graded, brown, wet	680.43 678.93		6MC 25-30' -103		60		0.0
26	SM/GM-SAND AND GRAVEL, with silt, loose, fine to medium grained sand, fine and coarse grained subrounded gravel, poorly graded, brown, wet							
28				7MC 30-35' -102		100		0.0
30	- 1" highly oxidized at 30.9ft BGS	673.43						
32	SP-SAND, trace to with silt, compact, fine grained, poorly graded, brown, wet - 4" medium grained sand at 33.0ft BGS							
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

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PROJECT NAME: 12TH ST LANDFILL

HOLE DESIGNATION: MW-102D

PROJECT NUMBER: 056393

DATE COMPLETED: January 27, 2011

CLIENT: WEYERHAEUSER COMPANY

DRILLING METHOD: DIRECT PUSH

LOCATION: OTSEGO, MI

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	N' VALUE	PID (ppm)
36	<ul style="list-style-type: none"><li>- 2.5" lens coarse grained sand and coarse grained gravel at 38.4ft BGS</li><li>- medium grained sand at 39.4ft BGS</li><li>- 1/4" lens highly oxidized at 39.6ft BGS</li><li>- fine grained at 40.5ft BGS</li></ul>		<p>BENTONITE CHIPS</p> <p>2" PVC WELL SCREEN</p> <p>SAND PACK</p>	8MC		90		0.0
38				35-40				
40				-101				
42								
44	END OF BOREHOLE @ 45.0ft BGS	659.43	<p><u>WELL DETAILS</u> Screened interval: 664.43 to 659.43ft 40.00 to 45.00ft BGS Length: 5ft Diameter: 2in Slot Size: 0.010 Material: PVC Seal: 668.43 to 665.43ft 36.00 to 39.00ft BGS Material: BENTONITE CHIPS Sand Pack: 665.43 to 659.43ft 39.00 to 45.00ft BGS Material: #4 SAND</p>	9MC		80		0.0
46				40-45				
48				-098				
50								
52								
54								
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-103D  
DATE COMPLETED: January 24, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	N' VALUE	PID (ppm)
	NORTHING: 351560.36 EASTING: 12771348.5 TOP OF CASING GROUND SURFACE	707.36 704.37						
2	SM/ML-SANDY SILT (TOPSOIL), loose, no plasticity, brown, moist	703.87	CONCRETE					
4	SM-SILTY SAND (FILL), trace fine grained gravel, compact, fine grained, poorly graded, light brown, moist		BENTONITE GROUT	1MC		60		0.0
6	SM/ML-SANDY SILT (FILL), trace gravel, compact, no plasticity, light brown, moist	698.37	2" PVC WELL CASING					
8	- 2" lens silty clay, gray at 7.9ft BGS - brownish gray at 8.6ft BGS	695.87	8" BOREHOLE	2MC		80		0.0
10	SM-SAND, with silt, compact, fine grained, poorly graded, oxidized yellowish brown, wet							
12	- silty sand at 12.0ft BGS			9-14' -095 3MC		40		0.0
14		689.87						
16	SP-GRAVELLY SAND, trace to with silt, loose, medium grained sand, fine grained subrounded gravel, poorly graded, yellowish brown, wet			14-19' -093 4MC		80		0.0
18	- fine grained sand, trace to with silt, laminated, light brown at 17.5ft BGS							
20								
22				19-24' -091 5MC		100		0.0
24								
26	- trace fine grained subrounded gravel at 26.2ft BGS			24-29' -089 6MC				0.0
28	- gravel not present, sand with silt at 27.0ft BGS		BENTONITE CHIPS					
30								
32			2" PVC WELL SCREEN	29-34' -087 7MC		60		0.0
34			SAND PACK					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 2 of 2

PROJECT NAME: 12TH ST LANDFILL

PROJECT NUMBER: 056393

CLIENT: WEYERHAEUSER COMPANY

LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-103D

DATE COMPLETED: January 24, 2011

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
36	- 6" dilatant sandy silt at 36.0ft BGS		<u>WELL DETAILS</u> Screened interval: 674.37 to 669.37ft 30.00 to 35.00ft BGS Length: 5ft Diameter: 2in Slot Size: 0.010 Material: PVC Seal: 677.37 to 675.37ft 27.00 to 29.00ft BGS Material: BENTONITE CHIPS Sand Pack: 675.37 to 669.37ft 29.00 to 35.00ft BGS Material: #4 SAND	34-39 -084				
38	SW/GW-SAND AND GRAVEL, compact, fine to medium grained sand, fine grained gravel, well graded, brown, wet	666.87		8MC		100		0.0
40	END OF BOREHOLE @ 37.5ft BGS	664.87						
42	SM-SILTY SAND, compact, fine grained, poorly graded, brown, wet	662.37		39-44 -081		100		0.0
44	SW-SAND, trace to with silt, compact, fine to medium grained, well graded, brown, wet	660.87		9MC				
46	SM-SAND, with silt, compact, fine grained, poorly graded, brown, wet							
48	- 6" medium grained sand at 48.0ft BGS			44-49 -079		60		0.0
50		654.37		10MC				
52								
54								
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

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PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-104S  
DATE COMPLETED: January 25, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	N' VALUE	
	NORTHING: 351657.92 EASTING: 12771512.37 TOP OF CASING GROUND SURFACE	706.55 703.86						
	OL-ORGANIC SANDY SILT, trace peat, loose, black, moist	703.16	CONCRETE					
2	SM-SILTY SAND, trace fine grained subrounded gravel, compact, fine grained, poorly graded, light brown, moist		BENTONITE GROUT					
4	OL-ORGANIC SILT, trace sand, trace clay, compact, slight plasticity, dark brown, trace olive lenses, moist	700.36 699.36	2" PVC WELL CASING					
6	SP-SAND, trace silt, compact, medium grained sand, poorly graded, olive brown, wet - medium grained at 7.0ft BGS		8" BOREHOLE					
8	SP/GP-SAND AND GRAVEL, compact, medium to coarse grained sand, fine grained gravel, poorly graded, yellowish brown, wet	696.36						
10	SP-SAND, trace fine grained subrounded gravel, compact, medium grained, poorly graded, light brown, wet	694.36						
12								
14	- gravelly sand at 13.0ft BGS							
16	- fine grained sand at 14.5ft BGS							
18	- 1/4" lens silty clay at 17.0ft BGS - gravelly coarse grained sand at 17.0ft BGS - medium grained sand at 17.8ft BGS - 3" lens, coarse gravel, with sand at 18.4ft BGS - fine grained sand at 18.7ft BGS		BENTONITE CHIPS					
20								
22			2" PVC WELL SCREEN					
24	- 4" lens coarse grained gravel at 24.6ft BGS		SAND PACK					
26	- coarse grained sand, with fine grained gravel at 25.5ft BGS END OF BOREHOLE @ 25.5ft BGS	678.36						
28								
30								
32								
34								

## WELL DETAILS

Screened interval:

685.36 to 678.36ft

18.50 to 25.50ft BGS

Length: 7ft

Diameter: 2in

Slot Size: 0.010

Material: PVC

Seal:

688.36 to 686.36ft

15.50 to 17.50ft BGS

Material: BENTONITE CHIPS

Sand Pack:

686.36 to 678.36ft

17.50 to 25.50ft BGS

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11





# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 2 of 2

PROJECT NAME: 12TH ST LANDFILL

HOLE DESIGNATION: MW-104S

PROJECT NUMBER: 056393

DATE COMPLETED: January 25, 2011

CLIENT: WEYERHAEUSER COMPANY

DRILLING METHOD: DIRECT PUSH

LOCATION: OTSEGO, MI

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	
36			Material: #4 SAND					
38								
40								
42								
44								
46								
48								
50								
52								
54								
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-104D  
DATE COMPLETED: January 25, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	NORTHING: 351658.87 EASTING: 12771508.51	TOP OF CASING 706.42 GROUND SURFACE 703.48						
	OL-ORGANIC SANDY SILT, trace peat, loose, black, moist	702.78	CONCRETE					
2	SM-SILTY SAND, trace fine grained subrounded gravel, compact, fine grained, poorly graded, light brown, moist		BENTONITE GROUT	1MC		60		0.0
4	OL-ORGANIC SILT, trace sand, trace clay, compact, slight plasticity, dark brown, trace olive lenses, moist	699.98 698.98	2" PVC WELL CASING					
6	SP-SAND, trace silt, compact, medium grained sand, poorly graded, olive brown, wet		8" BOREHOLE					
	- medium grained at 7.0ft BGS							
8	SP/GP-SAND AND GRAVEL, compact, medium to coarse grained sand, fine grained gravel, poorly graded, yellowish brown, wet	695.98		2MC 5-10 -053		80		0.0
10	SP-SAND, trace fine grained subrounded gravel, compact, medium grained, poorly graded, light brown, wet	693.98						
12								
	- gravelly sand at 13.0ft BGS			3MC 10-15 -051		80		0.0
14	- fine grained sand at 14.5ft BGS							
16								
	- 1/4" lens silty clay at 17.0ft BGS							
18	- gravelly coarse grained sand at 17.0ft BGS			4MC 15-20 -049		100		0.0
	- medium grained sand at 17.8ft BGS							
	- 3" lens, coarse gravel, with sand at 18.4ft BGS							
20	- fine grained sand at 18.7ft BGS							
22								
				5MC 20-25 -047		60		0.0
24	- 4" lens coarse grained gravel at 24.6ft BGS							
	- coarse grained sand, with fine grained gravel at 25.5ft BGS							
26	- fine grained sand at 26.0ft BGS							
28								
				6MC 25-30 -046		100		0.0
30								
	- gravelly sand, fine grained gravel, coarse grained sand, occasional highly oxidized lenses up to 1/4" thick at 31.5ft BGS							
32	- 1/8" lens dark brown sandy silt at 32.8ft BGS			7MC 30-35 -042		80		0.0
	- fine grained sand at 32.9ft BGS							
34	- medium grained sand at 34.6ft BGS							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 2 of 2

PROJECT NAME: 12TH ST LANDFILL

PROJECT NUMBER: 056393

CLIENT: WEYERHAEUSER COMPANY

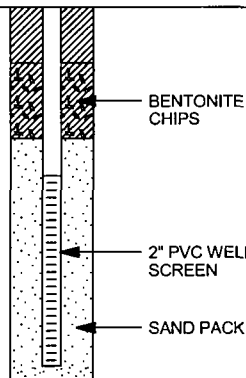
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-104D

DATE COMPLETED: January 25, 2011

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
36	- fine grained sand at 36.0ft BGS	658.48		8MC 35-40 -040		70		0.0
38								
40	- 6" lens laminated sand and silty sand at 39.5ft BGS			9MC 40-45 -036		70		0.0
42								
44	- slight increase in grain size at 43.0ft BGS							
46	END OF BOREHOLE @ 45.0ft BGS							
48								
50								
52								
54								
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11

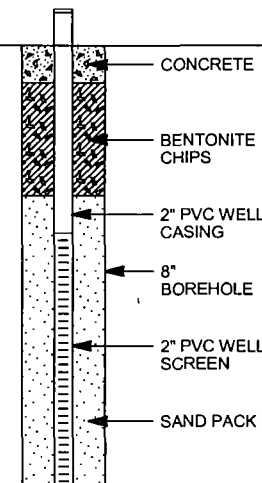


# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

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PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-105S  
DATE COMPLETED: January 26, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	N' VALUE	
	NORTHING: 351648.25 EASTING: 12771740.97	TOP OF CASING GROUND SURFACE 707.86 704.89						
	PT-PEAT, trace silt, loose, brown, moist							
2	SM-SILTY SAND, trace fine grained gravel, compact, fine grained, poorly graded, brown, moist	704.09	 <p>CONCRETE BENTONITE CHIPS 2" PVC WELL CASING 8" BOREHOLE 2" PVC WELL SCREEN SAND PACK</p>					
4								
6	OL-ORGANIC SILT, trace peat, loose, brown, very moist	700.19						
8	SM-SILTY SAND, trace fine grained subrounded gravel, loose, fine grained, poorly graded, olive gray and brown, highly oxidized, wet	697.89						
10	- 1.5" lens fine grained sand at 7.4ft BGS - 3" highly oxidized at 7.6ft BGS	696.89						
12	SP-GRAVELLY SAND, compact, coarse grained sand, fine grained subrounded gravel, poorly graded, yellowish brown, wet							
	- sand, trace gravel, medium grained at 11.0ft BGS	692.89						
14	END OF BOREHOLE @ 12.0ft BGS							
16								
18								
20								
22								
24								
26								
28								
30								
32								
34								

**WELL DETAILS**  
Screened interval:  
699.89 to 692.89ft  
5.00 to 12.00ft BGS  
Length: 7ft  
Diameter: 2in  
Slot Size: 0.010  
Material: PVC  
Seal:  
703.89 to 700.89ft  
1.00 to 4.00ft BGS  
Material: BENTONITE CHIPS  
Sand Pack:  
700.89 to 692.89ft  
4.00 to 12.00ft BGS  
Material: #4 SAND

**NOTES:** MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL

PROJECT NUMBER: 056393

CLIENT: WEYERHAEUSER COMPANY

LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-105D

DATE COMPLETED: January 26, 2011

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	NORTHING: 351649.34 EASTING: 12771736.18	TOP OF CASING GROUND SURFACE 707.89 704.79						
	PT-PEAT, trace silt, loose, brown, moist		CONCRETE					
2	SM-SILTY SAND, trace fine grained gravel, compact, fine grained, poorly graded, brown, moist	703.99	BENTONITE GROUT	1MC		70		0.0
4			2" PVC WELL CASING					
6	OL-ORGANIC SILT, trace peat, loose, brown, very moist	700.09	8" BOREHOLE					
8	SM-SILTY SAND, trace fine grained subrounded gravel, loose, fine grained, poorly graded, olive gray and brown, highly oxidized, wet	697.79		2MC		80		0.0
10	- 1.5" lens fine grained sand at 7.4ft BGS - 3" highly oxidized at 7.6ft BGS	696.79		7-12 -054				
12	SP-GRAVELLY SAND, compact, coarse grained sand, fine grained subrounded gravel, poorly graded, yellowish brown, wet			3MC		80		0.0
14	- sand, trace gravel, medium grained at 11.0ft BGS			12-17 -052				
16								
18	- 3" lens highly oxidized at 17.0ft BGS - fine grained sand, occasional clay lenses up to 1/8" thick at 17.5ft BGS - clay lenses not present at 19.0ft BGS			4MC		90		0.0
20				17-22 -050				
22	- 3" lens clayey sand at 20.5ft BGS	684.09						
24	GP-SANDY GRAVEL, loose, coarse grained sand, fine grained subrounded gravel, poorly graded, yellowish brown, wet, several oxidized lenses	681.79		5MC		100		0.0
26	- 2" lens medium grained sand at 22.5ft BGS - 2" lens fine grained sand at 22.7ft BGS	680.29		22-32 -048				
28	SM-SILTY SAND, trace fine grained subrounded gravel, compact, fine grained, poorly graded, light brown, wet	679.29						
30	- 1" lens silty clay at 24.8ft BGS	677.79		6MC		80		0.0
32	GP-SANDY GRAVEL, compact, fine and coarse grained gravel, coarse grained sand, poorly graded, yellowish brown, wet			27-32 -044				
34	SP-SAND, trace gravel, compact, fine grained, poorly graded, yellowish brown, wet							
	SP/GP-GRAVEL AND SAND, compact, coarse grained sand, fine grained subrounded gravel, poorly graded, brown, wet			7MC		80		0.0
	- 1/4" lens highly oxidized at 28.5ft BGS	672.29		32-37 -041				
	SP-SAND, compact, fine grained, poorly graded, light brown, wet							
	- coarse grained, trace fine grained gravel at							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11

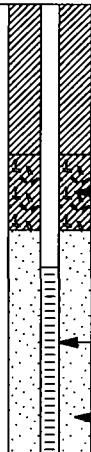


# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 2 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-105D  
DATE COMPLETED: January 26, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
36	33.2ft BGS - fine grained sand at 34.0ft BGS - 2" lens sand with fine grained gravel at 36.5ft BGS		 BENTONITE CHIPS 2" PVC WELL SCREEN SAND PACK	8MC		80		0.0
38				37-42 -039				
40				9MC		80		0.0
42				42-47 -034				
44	- slight increase in grain size at 44.0ft BGS							
46								
48				10MC				0.0
50	END OF BOREHOLE @ 50.0ft BGS	654.79						
52								
54								
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: 12TH ST LANDFILL

PROJECT NUMBER: 056393

CLIENT: WEYERHAEUSER COMPANY

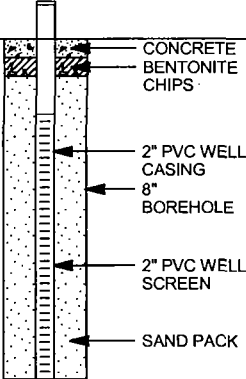
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-106S

DATE COMPLETED: January 28, 2011

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE			
				NUMBER	INTERVAL	REC (%)	'N' VALUE
	NORTHING: 351569.83 EASTING: 12771929.54  TOP OF CASING GROUND SURFACE	706.96 703.89					
2	ML-SILT, with sand, trace gravel, rootlets, compact, no plasticity, dark brown, moist - 6" light brown at 1.3ft BGS						
4	- 4" light brown, very moist at 3.5ft BGS - gray, wet at 4.1ft BGS - sandy silt, trace fine grained gravel at 4.5ft BGS						
6	- loose at 5.5ft BGS						
8	- olive gray at 7.0ft BGS						
10	END OF BOREHOLE @ 9.0ft BGS	694.89	<b>WELL DETAILS</b> Screened interval: 701.89 to 694.89ft 2.00 to 9.00ft BGS Length: 7ft Diameter: 2in Slot Size: 0.010 Material: PVC Seal: 703.39 to 702.89ft 0.50 to 1.00ft BGS Material: BENTONITE CHIPS Sand Pack: 702.89 to 694.89ft 1.00 to 9.00ft BGS Material: #4 SAND				
12							
14							
16							
18							
20							
22							
24							
26							
28							
30							
32							
34							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-106D  
DATE COMPLETED: January 28, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	N' VALUE	PID (ppm)
	NORTHING: 351572.37 EASTING: 12771932.52	TOP OF CASING GROUND SURFACE 706.36 703.66						
2	ML-SILT, with sand, trace gravel, rootlets, compact, no plasticity, dark brown, moist - 6" light brown at 1.3ft BGS		CONCRETE					
4	- 4" light brown, very moist at 3.5ft BGS - gray, wet at 4.1ft BGS - sandy silt, trace fine grained gravel at 4.5ft BGS - loose at 5.5ft BGS - olive gray at 7.0ft BGS		BENTONITE GROUT	1MC		80		0.0
6			2" PVC WELL CASING					
8			8" BOREHOLE	4-9' -033				
10				2MC		40		0.0
12	GP-GRAVEL, with sand, compact, fine grained subrounded gravel, medium grained sand, poorly graded, brown, wet	692.66		9-14' -030				
14	SP-SAND, trace to with silt, compact, fine grained, poorly graded, brown, wet	691.16		3MC		80		0.0
16	GP-SANDY GRAVEL, compact, coarse grained sand, fine grained subrounded gravel, brown, wet	688.16		14-19' -028		60		0.0
18				4MC				
20								
22	SP-SAND, with gravel, compact, medium to coarse grained sand, fine grained gravel, poorly graded, yellowish brown, wet	683.16		19-24' -024		80		0.0
24				5MC				
26	- fine grained sand at 26.0ft BGS			24-29' -021		80		0.0
28	GP-GRAVEL, with sand, compact, fine grained subrounded gravel, poorly graded, gray, wet	675.66		6MC				
30								
32	SP-SAND, loose, coarse grained, poorly graded, brown, wet	672.16		29-34' -019		70		0.0
34	GP-GRAVEL, with sand, loose, fine grained	669.66		7MC				
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE								
CHEMICAL ANALYSIS								

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11





# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 2 of 2

PROJECT NAME: 12TH ST LANDFILL

PROJECT NUMBER: 056393

CLIENT: WEYERHAEUSER COMPANY

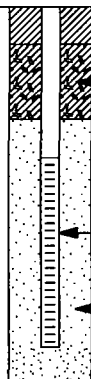
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-106D

DATE COMPLETED: January 28, 2011

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	"N" VALUE	PID (ppm)
36	subrounded gravel, poorly graded, brown, wet	668.16	 <p>BENTONITE CHIPS</p> <p>2" PVC WELL SCREEN</p> <p>SAND PACK</p>	34-39 -016	8MC	80		0.0
38	SP-SAND, trace silt, compact, medium grained, poorly graded, brown, wet							
40	- fine grained, light brown at 36.0ft BGS							
42				39-44 -014	9MC	100		0.0
44								
46	END OF BOREHOLE @ 45.0ft BGS	658.66						
48								
50								
52								
54								
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11

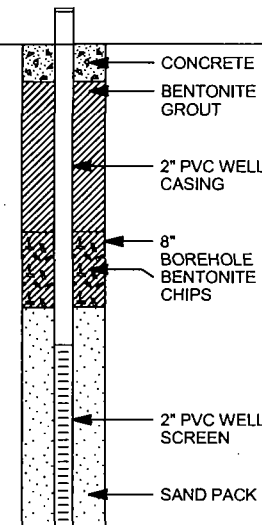


# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-107S  
DATE COMPLETED: January 24, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	"N" VALUE	PID (ppm)
	NORTHING: 351407.74 EASTING: 12771921.37	TOP OF CASING GROUND SURFACE 706.73 703.76						
	ML-SILT TOPSOIL, trace sand, trace gravel, loose, dark brown, moist	703.56						
2	SM-SILTY SAND (FILL), trace gravel, compact, fine grained, poorly graded, brown, moist	702.56		1MC		60		0.0
4	SP-SAND, trace silt, compact, medium grained, poorly graded, light brown, moist							
6	- medium to coarse grained, reddish brown at 3.1ft BGS							
6	- yellowish brown, wet at 4.0ft BGS			4-9 -032				
8	- brownish gray at 4.6ft BGS			2MC		80		0.0
8	- trace coarse grained subrounded gravel at 6.0ft BGS	696.26						
10	GP-SANDY GRAVEL, loose, medium grained sand, fine grained gravel, gray, wet							
10	- brown at 8.0ft BGS			9-14 -029				
12	- fine to coarse grained gravel at 10.0ft BGS			3MC		40		0.0
14			<p><b>WELL DETAILS</b> Screened interval: 695.76 to 690.76ft 8.00 to 13.00ft BGS Length: 5ft Diameter: 2in Slot Size: 0.010 Material: PVC Seal: 698.76 to 696.76ft 5.00 to 7.00ft BGS Material: BENTONITE CHIPS Sand Pack: 696.76 to 690.76ft 7.00 to 13.00ft BGS Material: #4 SAND</p>					
16	- gravel with sand at 15.0ft BGS			14-19 -025		40		0.0
18	- 6" highly oxidized at 18.5ft BGS							
20	- sandy gravel at 19.5ft BGS			19-24 -022		50		0.0
22								
24	- 6" silty clay, trace fine grained gravel, brown at 24.5ft BGS			24-29 -020		20		0.0
26								
28				29-34 -018		0		0.0
30	- no recovery from 30 to 35' bgs at 30.0ft BGS			7MC				
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

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PROJECT NAME: 12TH ST LANDFILL

HOLE DESIGNATION: MW-107S

PROJECT NUMBER: 056393

DATE COMPLETED: January 24, 2011

CLIENT: WEYERHAEUSER COMPANY

DRILLING METHOD: DIRECT PUSH

LOCATION: OTSEGO, MI

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
36	SP-SAND, trace silt, compact, fine grained, poorly graded, brown, wet, occasional oxidized lenses	668.26		34-39' -015	8MC	100		0.0
38								
40								
42				39-44' -013				
44	END OF BOREHOLE @ 45.0ft BGS	658.76		9MC		0		0.0
46								
48								
50								
52								
54								
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11

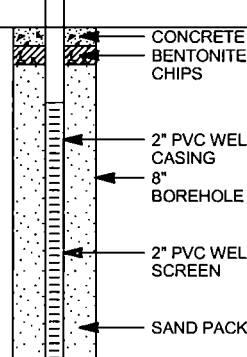


# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-108S  
DATE COMPLETED: January 28, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE					
				NUMBER	INTERVAL	REC (%)	'N' VALUE		
	NORTHING: 351314.94 EASTING: 12771922.19  TOP OF CASING GROUND SURFACE	706.21 703.32							
2	SM/ML-SANDY SILT (FILL), loose, no plasticity, dark brown, moist - 3" wood debris (root) at 1.0ft BGS - 6" lens silty sand at 2.3ft BGS		 <p>CONCRETE BENTONITE CHIPS</p> <p>2" PVC WELL CASING</p> <p>8" BOREHOLE</p> <p>2" PVC WELL SCREEN</p> <p>SAND PACK</p> <p><b>WELL DETAILS</b> Screened interval: 701.32 to 694.32ft 2.00 to 9.00ft BGS Length: 7ft Diameter: 2in Slot Size: 0.010 Material: PVC Seal: 702.82 to 702.32ft 0.50 to 1.00ft BGS Material: BENTONITE CHIPS Sand Pack: 702.32 to 694.32ft 1.00 to 9.00ft BGS Material: #4 SAND</p>						
4	SP-SAND, with gravel, trace silt, compact, coarse grained sand, fine grained subrounded gravel, poorly graded, gray, wet	699.32							
6	ML-SILT, with sand, loose, no plasticity, brown, wet	697.32							
8	GM-SILTY GRAVEL, trace sand, loose, coarse grained gravel, poorly graded, brown, wet	695.82							
10	SP/GP-SAND AND GRAVEL, trace silt, compact, coarse grained sand, fine grained gravel, trace coarse grained gravel, poorly graded, brown, wet	695.12							
12	END OF BOREHOLE @ 9.0ft BGS	694.32							
14									
16									
18									
20									
22									
24									
26									
28									
30									
32									
34									

**NOTES:** MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL

PROJECT NUMBER: 056393

CLIENT: WEYERHAEUSER COMPANY

LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-108D

DATE COMPLETED: January 28, 2011

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	NORTHING: 351320.9 EASTING: 12771921.79	TOP OF CASING GROUND SURFACE 706.16 703.39						
2	SM/ML-SANDY SILT (FILL), loose, no plasticity, dark brown, moist - 3" wood debris (root) at 1.0ft BGS - 6" lens silty sand at 2.3ft BGS		CONCRETE	1MC		60		0.0
4	SP-SAND, with gravel, trace silt, compact, coarse grained sand, fine grained subrounded gravel, poorly graded, gray, wet	699.39	BENTONITE GROUT					
6	ML-SILT, with sand, loose, no plasticity, brown, wet	697.39	2" PVC WELL CASING					
8	GM-SILTY GRAVEL, trace sand, loose, coarse grained gravel, poorly graded, brown, wet SP/GP-SAND AND GRAVEL, trace silt, compact, coarse grained sand, fine grained gravel, trace coarse grained gravel, poorly graded, brown, wet	695.89 695.19	8" BOREHOLE	4-9' -076	2MC	60		0.0
10				9-14' -075	3MC	20		0.0
12				14-19' -068	4MC	80		0.0
14				19-24' -066	5MC	20		0.0
16				24-29' -064	6MC	40		0.0
18	- 3" lens silty sand and gravel at 17.5ft BGS - fine to coarse grained gravel, medium grained sand at 18.0ft BGS			29-34' -062	7MC	60		0.0
20								
22								
24								
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 2 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-108D  
DATE COMPLETED: January 28, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	N' VALUE	PID (ppm)
36								
38								
40	SP-SAND, trace silt, compact, fine grained, poorly graded, light brown, wet	664.39				80		0.0
42								
44						60		0.0
46	END OF BOREHOLE @ 45.0ft BGS	658.39						
48								
50								
52								
54								
56								
58								
60								
62								
64								
66								
68								

**WELL DETAILS**  
Screened interval:  
663.39 to 658.39ft  
40.00 to 45.00ft BGS  
Length: 5ft  
Diameter: 2in  
Slot Size: 0.010  
Material: PVC  
Seal:  
667.39 to 664.39ft  
36.00 to 39.00ft BGS  
Material: BENTONITE CHIPS  
Sand Pack:  
664.39 to 658.39ft  
39.00 to 45.00ft BGS  
Material: #4 SAND

**NOTES:** MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL

PROJECT NUMBER: 056393

CLIENT: WEYERHAEUSER COMPANY

LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-109D

DATE COMPLETED: January 31, 2011

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	N' VALUE	PID (ppm)
	NORTHING: 351199.24 EASTING: 12771714.08	TOP OF CASING GROUND SURFACE	710.46 707.41					
	SM-SILTY SAND (TOPSOIL, FILL), loose, brown, moist	706.01	CONCRETE					
2	SM-SILTY SAND (FILL), trace gravel, compact, fine grained, poorly graded, light brown, moist	704.41	BENTONITE GROUT	1MC		80		0.0
	- 3" lens coarse grained gravel at 2.2ft BGS	703.91	2" PVC WELL CASING					
4	SM-SILTY SAND (natural), compact, fine grained, poorly graded, rusty brown, moist		8" BOREHOLE					
6	SP-SAND, with silt, compact, fine grained, poorly graded, light yellowish brown, moist			2MC		20		0.0
8	- occasional oxidized lenses 1/8" thick at 4.5ft BGS							
	- wet at 7.0ft BGS							
10		697.41		7-12 -077				
12	GP-SANDY GRAVEL, loose, fine and coarse grained subrounded gravel, poorly graded, brown, wet			3MC		10		0.0
14				12-17 -074				
16		691.41	BENTONITE CHIPS					
18	SP/GP-SAND AND GRAVEL, compact, fine and coarse grained sand, fine grained gravel, poorly graded, yellowish brown, wet			4MC		60		0.0
20			2" PVC WELL SCREEN	17-22 -070				
22			SAND PACK	5MC		40		0.0
24	- medium brown at 24.0ft BGS			22-27 -067				
26								
28				6MC		80		0.0
30	SP-SAND, trace silt, compact, fine grained, poorly graded, brown, wet	678.41		27-32 -065				
	- medium grained at 31.0ft BGS							
32	- coarse grained, trace fine grained subrounded gravel at 32.0ft BGS	674.91		32-37 -063		60		0.0
34	SP/GP-SAND AND GRAVEL, trace silt, compact, coarse grained sand, fine grained subrounded gravel, poorly graded, yellowish							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 2 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-109D  
DATE COMPLETED: January 31, 2011  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	N VALUE	PID (ppm)
36	brown, wet	671.41		8MC		100		0.0
38	SP-SAND, with silt, compact, fine grained, poorly graded, light brown, wet							
40		662.41		9MC		80		0.0
42								
44		662.41						
46	END OF BOREHOLE @ 45.0ft BGS							
48								
50								
52								
54								
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11





# STRATIGRAPHIC LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL

HOLE DESIGNATION: MW-110

PROJECT NUMBER: 056393

DATE COMPLETED: November 18, 2010

CLIENT: WEYERHAEUSER COMPANY

DRILLING METHOD: DIRECT PUSH

LOCATION: OTSEGO, MI

FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE				
			NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	SM-SANDY SILT (TOPSOIL, FILL), trace gravel, compact, brown, moist, roots present						
2	SM-SILTY SAND (natural), trace fine grained gravel, compact, fine grained, poorly graded, rusty brown, moist	1.50	1MC		60		0.0
4	SP/GP-SAND AND GRAVEL, compact, medium grained sand, fine grained subrounded gravel, brown, moist - light brown at 4.0ft BGS	3.00					
6							
8	- cobble at 7.0ft BGS - cobble at 8.0ft BGS	8.40	2MC		80		0.0
10	SP-SAND, trace gravel, compact, coarse grained sand, poorly graded, light brown, moist						
12							
14	- gravelly sand at 13.0ft BGS - sand, with gravel, yellowish brown, moist to very moist at 14.0ft BGS		3MC		80		0.0
16							
18	SM/GM-SAND AND GRAVEL, trace to with silt, loose, medium grained sand, fine grained subrounded gravel, yellowish brown, wet	17.00	4MC		60		0.0
20			17-22 -096				
22	- dark brown at 22.0ft BGS - trace coarse grained subrounded gravel at 23.0ft BGS		5MC		60		0.0
24			22-27 -092				
26							
28			6MC		0		0.0
30			27-32 -090				
32	GP-SANDY GRAVEL, with silt, compact, fine grained subrounded gravel, medium grained sand, poorly graded, yellowish brown, highly oxidized, wet	30.50	7MC		80		0.0
34	SP-GRAVELLY SAND, trace silt, compact, medium grained sand, poorly	34.00	32-37 -088				

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC LOG (OVERBURDEN)

Page 2 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: MW-110  
DATE COMPLETED: November 18, 2010  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER / E. VARNAS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE				
			NUMBER	INTERVAL	REC (%)	"N" VALUE	PID (ppm)
36	graded, grayish brown, wet						
38	SP/GP-SAND AND GRAVEL, trace silt, compact, medium grained sand, fine grained subrounded gravel, trace coarse grained gravel, poorly graded, grayish brown, wet	37.50	8MC		80		0.0
40			37-42 -082				
42			9MC		80		0.0
44	SP-SAND, trace to with silt, compact, fine grained, poorly graded, brown, wet		42-47 -080				
46		47.00	10MC		80		0.0
48			47-52 -078				
50			11MC		100		0.0
52			52-57 -076				
54		55.00					
56	END OF BOREHOLE @ 55.0ft BGS						
58	NOTE: TEMPORARY WELL INSTALLED DURING VERTICAL AQUIFER SAMPLING						
60							
62							
64							
66							
68							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS ☐

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11

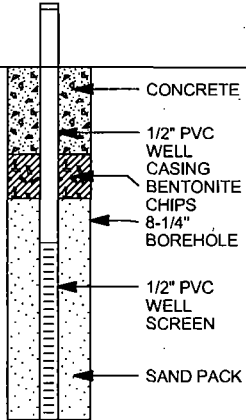


# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: GP-1  
DATE COMPLETED: November 23, 2010  
DRILLING METHOD: 4-1/4" HSA  
FIELD PERSONNEL: D. DEITNER

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	GAS PROBE	SAMPLE			
				NUMBER	INTERVAL	REC (%)	'N' VALUE
	NORTHING: 351278.28 EASTING: 12771784.69  TOP OF CASING GROUND SURFACE	709.88 707.35					
2	SM/ML-SANDY SILT (FILL), trace fine grained gravel, compact, fine grained sand, no plasticity, brown, moist						
4	END OF BOREHOLE @ 4.0ft BGS	703.35	<u>WELL DETAILS</u> Screened interval: 705.35 to 703.35ft 2.00 to 4.00ft BGS Length: 2ft Diameter: 0.5in Slot Size: 0.010 Material: PVC Seal: 706.35 to 705.85ft 1.00 to 1.50ft BGS Material: BENTONITE CHIPS Sand Pack: 705.85 to 703.35ft 1.50 to 4.00ft BGS Material: #3 SAND				
6							
8							
10							
12							
14							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 2

PROJECT NAME: 12TH ST LANDFILL  
PROJECT NUMBER: 056393  
CLIENT: WEYERHAEUSER COMPANY  
LOCATION: OTSEGO, MI

HOLE DESIGNATION: GP-2  
DATE COMPLETED: November 23, 2010  
DRILLING METHOD: DIRECT PUSH  
FIELD PERSONNEL: D. DEITNER

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	GAS PROBE	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	NORTHING: 351034 EASTING: 12771486.64 <div>TOP OF CASING GROUND SURFACE</div>	736.12 732.88						
2	SM/ML-SANDY SILT (FILL), trace fine grained gravel, compact, fine grained sand, no plasticity, brown, moist		<div><div>CONCRETE</div><div>1/2" PVC WELL CASING</div><div>BENTONITE CHIPS</div><div>8-1/4" BOREHOLE</div><div>1/2" PVC WELL SCREEN</div><div>SAND PACK</div></div> <div><div>WELL DETAILS</div><div>Screened interval: 727.88 to 702.88ft 5.00 to 30.00ft BGS</div><div>Length: 25ft Diameter: 0.5in Slot Size: 0.010 Material: PVC Seal: 731.88 to 728.88ft 1.00 to 4.00ft BGS Material: BENTONITE CHIPS Sand Pack:</div></div>	1MC		24		0.0
4								
6								
8	SP-SAND (natural), trace silt, compact, fine grained, poorly graded, light yellowish brown, laminated, occasional thin oxidized lenses 1/8" thick	726.38		2MC		16		0.0
10								
12								
14				3MC		40		0.0
16								
18				4MC		70		0.0
20	GP-SANDY GRAVEL, compact, fine grained sand, fine grained subrounded gravel, poorly graded, grayish brown, moist - fine grained gravel, trace coarse grained sand at 19.0ft BGS - fine grained gravel, with coarse grained sand, trace coarse grained gravel at 20.0ft BGS	714.38						
22								
24								
26	- occasional cobbles at 26.0ft BGS			5MC		70		0.0
28								
30	SP-SAND, trace fine grained gravel, compact, medium to coarse grained sand, poorly graded, light yellowish brown, moist	704.88		6MC		70		0.0
32								
34								
36	END OF BOREHOLE @ 35.0ft BGS	697.88	7MC		0		0.5	
38								
40								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 2 of 2

PROJECT NAME: 12TH ST LANDFILL

HOLE DESIGNATION: GP-2

PROJECT NUMBER: 056393

DATE COMPLETED: November 23, 2010

CLIENT: WEYERHAEUSER COMPANY

DRILLING METHOD: DIRECT PUSH

LOCATION: OTSEGO, MI

FIELD PERSONNEL: D. DEITNER

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	GAS PROBE	SAMPLE				
				NUMBER	INTERVAL	REC (%)	N-VALUE	PID (ppm)
44			728.88 to 700.88ft 4.00 to 32.00ft BGS Material: #3 SAND					
46								
48								
50								
52								
54								
56								
58								
60								
62								
64								
66								
68								
70								
72								
74								
76								
78								
80								
82								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: 12TH ST LANDFILL

HOLE DESIGNATION: GP-3

PROJECT NUMBER: 056393

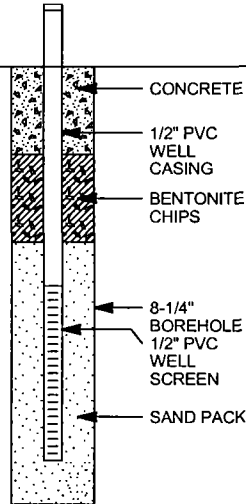
DATE COMPLETED: November 23, 2010

CLIENT: WEYERHAEUSER COMPANY

DRILLING METHOD: 4-1/4" HSA

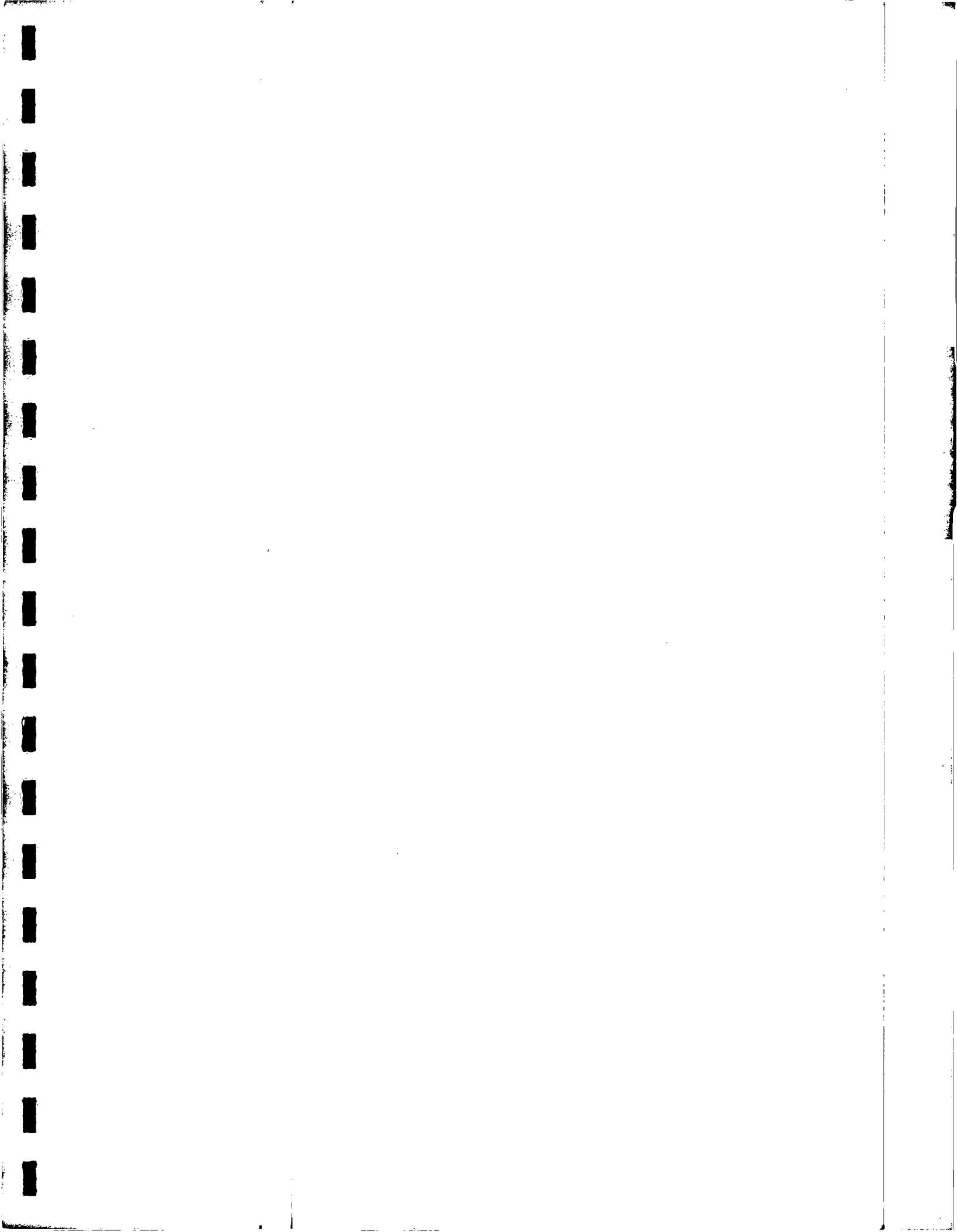
LOCATION: OTSEGO, MI

FIELD PERSONNEL: D. DEITNER

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft	GAS PROBE	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N VALUE	
	NORTHING: 351290.17 EASTING: 12771276.59	TOP OF CASING GROUND SURFACE 706.47 703.51						
2	SM/ML-SANDY SILT (FILL), trace fine grained gravel, compact, fine grained sand, no plasticity, brown, moist							
4								
6	END OF BOREHOLE @ 5.0ft BGS	698.51	<b>WELL DETAILS</b> Screened interval: 701.01 to 699.01ft 2.50 to 4.50ft BGS Length: 2ft Diameter: 0.5in Slot Size: 0.010 Material: PVC Seal: 702.51 to 701.51ft 1.00 to 2.00ft BGS Material: BENTONITE CHIPS Sand Pack: 701.51 to 698.51ft 2.00 to 5.00ft BGS Material: #3 SAND					
8								
10								
12								
14								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 056393WIN.GPJ CRA\_CORP.GDT 4/25/11





APPENDIX D  
SELECT FIELD SOPs FROM FIELD SAMPLING PLAN

## **Standard Operating Procedure F-10** **Staff Gauge Installation and Measurement**

This standard operating procedure (SOP) is applicable to the installation and measurement of staff gauges. This SOP is generic in nature and may be modified in whole or part depending on constraints presented by site conditions and equipment limitations. Modifications of methodologies will be documented in the appropriate field logbook and discussed in reports summarizing field activities. The procedures have been adapted from the Oklahoma Water Resources Program Division procedures for installation and monitoring of nonrecording staff gauges.

### **Installation of Staff Gauges**

The gauge height is a critical component for establishing the stage to discharge relationship and can be measured through a variety of accepted means. It is used to establish the river gauge, or height of water to a known fixed point. This known fixed point is referenced or leveled to a reference mark or benchmark. These marks are assigned either an arbitrary elevation or a known elevation that is tied to a national elevation network. Thus, over time, with periodic leveling, the reference points can be measured for movement. Movement of these points will affect the stage discharge rating; therefore, it is critical that periodic measurements be conducted so that the gauge heights remain leveled with the stage datum. This document is meant to be a guide only. Since staff gauge equipment varies with respect to installation requirements, this SOP will be provided for a guideline and the specific manufacturer's instruction manual will be relied upon for more detailed guidance on the use of specific staff gauges.

### **Accuracy and Use of Staff Gauges**

#### **Vertical Staff Gauges**

Vertical staff gauges are used as a standalone outside gauge, an outside gauge at a recording station, or a reference gauge to another nonrecording device. Vertical gauges are available in a variety of lengths, widths, and increments in both U.S. and metric scales. However, because of the necessary accuracy, comparability, and ruggedness, gauges should be a Style A gauge, if available, which is made of porcelain enameled iron sections measuring 3 1/2" by 4" and graduated at every foot, tenth, and 0.02 foot. They are accurate only to 0.02 foot and can be damaged or lost due to high flows or ice. They have a tendency to drift if not consistently kept free of debris. Accuracies to 0.01 foot may be obtained if needed by reading the gauge with a point gauge.

#### **Inclined Staff Gauges**

Because of their uniqueness to each station, inclined gauges are normally not available commercially for stream gauging. They are used in situations where placement of another type of outside gauge is not possible. They can be used as standalone outside gauges or as an outside gauge at a recording station.

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Inclined gauges have a low level of accuracy of up to 0.10 foot. Because of issues with installation, maintenance, and accuracy, inclined staff gauges should be used only when other options are not feasible.

### Installation and Measurement of Staff Gauges

A vertical gauge is mounted to a permanently placed structure such as a pier or beam sunk to bedrock. If mounted in a stable location, a number of plates may be mounted one on top of the other. When mounting, find the high water bench and attempt to place the top of the gauge above that mark. The vertical height of the gauges should be kept to one plate and may require the installation of two or more to account for the vertical height of banks and potential high water level. When mounting to a pier, special equipment may be needed. The gauge should be kept free of obstructions and be in an area readily accessible by personnel. A reference point should be placed on the backing of the gauge plates and tied into the level circuit, and a reference point reading should be noted by measuring against the steel plate using a steel tape. During subsequent surveys, new RP readings should be made and compared with the elevation for that reference point. If these are different, a correction should be made to the gauge datum. If a series of gauges are used, each should be tied to the level circuit with a separate reference point.

The water level is read by the following three-step method:

1. As an example, 20.64 is used as a measurement.
2. The footmark, 20.0, is noted. The next mark (6) is the inch mark.
3. The next step is to locate the hundredth mark and count 8 the marks backward from the next highest inch mark.

Using the example, the water level is at 0.64, and to determine the hundredth mark (0.04), the technician would count back from 0.7 to the water level. In this instance, the count was 0.06. By subtracting 0.06 from the inch mark, the hundredth mark (0.04) is obtained.

### References

Oklahoma Water Resources Board. 2004. Standard operating procedure for the installation of nonrecording gauges and measurement of stage in streams. Water Quality Program Division, Oklahoma City, Oklahoma.

Oklahoma Water Resources Board. 2004. Standard operating procedure for surveying gauging stations. Water Quality Program Division. Oklahoma City, Oklahoma.

## **Standard Operating Procedure F-11** **Groundwater Sampling and Field Measurement Procedures**

This standard operating procedure (SOP) sets forth the field procedures for the sampling of groundwater. The procedures include monitoring well inspection, groundwater elevation measurement, decontamination of nondedicated sampling equipment, and groundwater sampling.

### **Monitoring Well Inspection**

The condition of the monitoring wells will be inspected and documented during each sampling event prior to the collection of data. The following information will be noted on a monitoring well inspection form (Attachment B):

- The ground surface condition around the well (vegetation, safety hazards, access hazards, etc.)
- Well security features (presence of lock, lock key number, protective bollards, paint, visibility devices, evidence of tampering, traffic hazards, etc.)
- Condition of the well surface completion, including surface protector, protector cover, inner casing cap or plug, and concrete pad
- Evidence of potential contamination at the wellhead, including staining or suspicious containers

### **Groundwater Elevation Measurement**

In order to determine the static water elevation (SWE), the static water level (SWL) will be measured prior to purging and sampling at each monitoring well in the sampling program. All static water level measurements will be obtained on the first day of the sampling event or within a 24-hour period, except as described in the following section. The measurements will be obtained prior to purging the monitoring wells for water quality sampling. Each well has a top-of-casing (TOC) reference point marked on it, from which all water level measurements will be taken. The vertical reference points have been surveyed to the nearest 0.01 foot and referenced to North American Vertical Datum (NAVD) 88.

### **Decontamination Procedures for Nondedicated Sampling Equipment**

Proper decontamination of sampling equipment is essential to minimize the possibility of cross-contamination of samples. Nondedicated equipment used for sampling various environmental media (soil, groundwater, surface water, etc.) will be cleaned before its initial use in the field and again before use at each subsequent sampling site.

All nondedicated sampling equipment will be new, or will be decontaminated at RMT prior to its initial use on-site. Decontamination procedures will include the following steps:

1. Wash the equipment in a nonphosphate detergent.
2. Rinse with potable tap water.

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3. Rinse with deionized (DI) or distilled water.

Nondedicated equipment that is to be used at additional locations at the site will be field-decontaminated between sampling locations. Details regarding the decontamination of field equipment are included in the sampling procedures described below. The field decontamination procedures will be in accordance with the Michigan Department of Environmental Quality (MDEQ) Remediation and Redevelopment Division Operation Memorandum Number 2, Appendix 7 (MDEQ, 2004).

The field decontamination of sampling equipment will take place at the sampling location. All decontamination water and purge water will be contained in 5-gallon buckets and transported to the decontamination pad for collection with other decontamination wastewater, and will be containerized in a 55-gallon barrel that will be properly labeled and temporarily stored on-site. A sample of the decontamination water will be collected and tested for the parameters required by a permitted off-site disposal facility. Following receipt of the analytical results, the water will be transported and disposed at the off-site facility.

The field equipment blanks will be collected in accordance with the sampling methodology specified in Appendix 7 (MDEQ, 2004).

To the extent practicable, single-use sampling equipment and materials will be used for the collection of all environmental samples. The materials used will be new and clean, and will be placed in plastic for transport to the site. Once used, this equipment will be placed in plastic bags and managed as investigation-derived waste material.

## Groundwater Sampling Procedures

Groundwater samples from monitoring wells will be collected using a low-flow sampling methodology specifically designed for low-level mercury sampling. The sampling will be consistent with Attachment 7 (MDEQ, 2004).

Low-level mercury sample collection is performed by a strict protocol designed to minimize contamination. The protocol involves a two-person team approach. One member of the team is designated as "Dirty Hands," and the second member is designated as "Clean Hands." "Clean Hands" handles all operations involving contact with the sample bottle and transfer of the samples from the tubing or pump outlet to the sample bottle. "Dirty Hands" prepares the sampling equipment, operates the sampling equipment, and is responsible for any other activities that do not involve direct contact with the sample. Non-talc gloves and lint-free outer clothing are required to protect the samples from contamination by lint and dust. Sampling equipment, materials, and containers are cleaned and double-bagged for protection from contamination during storage and transportation. The field equipment is decontaminated with deionized water. The samples are preserved with high-purity, diluted hydrochloric acid (HCL).

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Each monitoring well will be pumped using a peristaltic pump and fluoropolymer tubing. At wells where the depth to water is greater than 20 feet, a QED bladder pump (or equivalent) will be used instead of the peristaltic pump. The bottom of the tubing (or bladder pump intake) will be placed approximately 1 to 2 feet above the base of the well screen, and the well will be pumped at a flow rate ranging from 0.1 to 0.7 liter/min. The pumping rate for each monitoring well is dependent on the hydraulic properties of the formation the well is screened across, and will be determined in the field to be the highest flow rate attainable without creating drawdown greater than approximately 0.1 meter, or at a minimum of 100 mL/min. In the event that the aquifer transmissivity is too low to yield sufficient water to limit drawdown to 0.1 meter at the lowest specified pumping rate (0.1 liter/min), sampling will be conducted at the 0.1 liter/min rate since this is the minimum flow rate necessary for accurate measurements through the flow-through cell.

A Geotech P3 flow-through cell (or equivalent) equipped with temperature, turbidity, dissolved oxygen, specific electrical conductance, and pH electrodes will be connected to the discharge tubing from the peristaltic pump. Each of these parameters will be measured at each well during purging to evaluate stabilization. Wells will be considered stable when the following conditions apply between three successive 1-liter sampling intervals:

- The temperature change is within 0.5°C.
- The conductance change is within 20  $\mu$ hmhos/cm.
- The turbidity change is  $\pm$  10 percent or <10 NTUs.
- The dissolved oxygen change is within 0.5 mg/L.
- The redox (Eh) change is within 30 mv.
- The pH change is within 0.2 pH units.

The wells will be sampled immediately following stabilization. The samples will be taken from the pump discharge after the flow-through cell has been disconnected. The low-level mercury sample will be collected first following the Clean Hands/Dirty Hands method described in Attachment 7 (MDEQ, 2004). The remaining sample bottles will then be collected from the pump discharge.

Regardless of the sampling technique used, efforts will be made to minimize agitation/disturbance of samples during purging and sampling activities. Likewise, efforts will be made to avoid purging wells dry if at all possible.

Groundwater purged during sampling, used pump tubing, and other general waste materials generated by the sampling process will be collected and managed as investigation-derived waste, as described in Section 5.

**Calibration Procedures** - The pH, ORP, specific conductance, turbidity, and dissolved oxygen meters will be calibrated daily in accordance with manufacturer's instructions. Calibration information will be recorded in the field logbook.

**Operation Procedures** - The sampling pump, flow-through cell, and meters will be operated according to the manufacturer's instructions.

**Maintenance Procedures** - The sampling pump, flow-through cell, and meters will be maintained according to the manufacturer's instructions. Maintenance information will be recorded in the field logbook. Replacement sampling pumps, flow-through cells, and meters will be available on-site or ready for overnight shipment, as necessary.

### Sample Handling and Chain of Custody

Field personnel will be aware of the holding times for specific parameters and will make arrangements to have the samples delivered to the laboratory to meet these holding times. No samples will be held overnight for field activities lasting longer than 1 day. All samples will be stored on ice after collection and shipped to the laboratory on the same day on which they are collected.

This Chain-of-Custody documentation enables possession of a sample to be traced from sample collection through analysis and disposal. A Chain-of-Custody protocol will be established to document control of the samples from the point of collection to delivery to the analytical laboratory. Samples will be under the custody of a designated person at all times. The control of custody will be documented on a Chain-of-Custody form supplied by the laboratory. The Chain-of-Custody form will document the names, signatures, and affiliations of personnel in custody of the samples, and the dates and times custody was transferred. The sampling personnel will be responsible for sample custody in the field. The laboratory sample custodian and analysts will be responsible for custody of the sample at the laboratory.

A copy of the Chain-of-Custody form will be placed in the project files, and the original will accompany the samples to the laboratory. The identity of field duplicate samples will not be disclosed to the analytical laboratory. Sample analysis request forms will be prepared by sampling personnel and reviewed by the project coordinator or project manager. The analytical request forms will either accompany the samples to the laboratory or will precede the delivery of samples to the laboratory.

Shipping containers will be sealed and will be accompanied by the Chain-of-Custody form, with appropriate signatures. The transfer of custody is the responsibility of the sampling personnel and the laboratory staff. The procedures to be implemented are as follows:

- Place completed chain-of-custody forms in a plastic bag, seal the bag, and tape it to the inside cover of the shipping container.

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- After the samples are iced, seal the coolers with strapping tape and custody seals (if applicable), add the date to the custody seals, and ship the coolers to the laboratory using overnight delivery or by delivering them directly to the laboratory.
- Identify common carriers or intermediate individuals on the Chain-of-Custody form, and retain copies of all bills-of-lading.
- When the samples are received in the laboratory, handle and process them in accordance with the procedures in the laboratory's standard operating procedures (SOPs), or specified analytical methods.

In the laboratory, a sample custodian will be assigned to receive the samples. Upon receipt of the samples, the custodian will inspect the condition of the samples, reconcile the samples received against the Chain-of-Custody form, check the temperature of the samples, log the samples in the laboratory log book, and store the samples in a secured sample storage room or cabinet maintained at an appropriate temperature until assigned to an analyst for analysis. Custody will be maintained until the samples are discarded.

When samples requiring preservation by either acid (except samples for VOC analysis) or base are received at the laboratory, the pH will be measured and documented. The laboratory sample custodian will adjust the pH, if necessary, and will notify the laboratory Quality Assurance/Quality Control (QA/QC) Coordinator of the pH adjustment so that sample collection procedures can be reviewed to determine if a modification is necessary.

Discrepancies observed between the samples received, the information on the Chain-of-Custody form, and the sample analysis request sheet will be resolved before the sample is assigned for analysis. The laboratory QA/QC Coordinator will be informed of any such discrepancy, as well as its resolution. Results of the inspection will be documented in the laboratory sample logbook. Discrepancies will be documented in the analytical case narrative, as appropriate.

#### References

- MDEQ. 2004. Remediation and Redevelopment Division operation memorandum Number 2.  
Appendix 7.



APPENDIX E  
HEALTH AND SAFETY PLAN



# **SITE-SPECIFIC HEALTH AND SAFETY PLAN**

**12<sup>TH</sup> STREET LANDFILL SITE  
PLAINWELL, MICHIGAN**

**Prepared For:  
Weyerhaeuser Company**

**DISCLAIMER:**  
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THE ORIGINAL CONTENT REMAINS UNCHANGED.

**APRIL 2012  
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**Prepared by:  
Conestoga-Rovers  
& Associates**

2055 Niagara Falls Boulevard, Suite #3  
Niagara Falls, New York  
U.S.A. 14304

Office: (716) 297-6150  
Fax: (716) 297-2265

web: <http://www.CRAworld.com>

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## 1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) has prepared this Health and Safety Plan (HASP) to support with the requirements of the Remedial Action Work Plan for the 12<sup>th</sup> Street Landfill Site (Site). The HASP presented herein describes the health and safety procedures and emergency response guidelines to be implemented during the Operation, Maintenance, and Monitoring (OM&M) Program at the Site. The Site is located in the town of Plainwell, Michigan. Figure 1.1 presents the Site Location and Figure 1.2 presents the Site Layout.

### 1.1 PURPOSE

The purpose of this Site-specific HASP is to provide specific guidelines and establish procedures for the protection of personnel performing project field activities that are described in the scope of work. The information in this HASP has been developed in accordance with applicable standards and is, to the extent possible, based on information available to date. The HASP is also a living document, in that it must continually evolve as Site conditions develop.

CRA is the primary contractor completing project activities at the Site. A vital element of CRA's Safety and Health Program is the implementation of a Site-specific HASP for field activities. The HASP, as applicable to this project, requires the following measures to be implemented:

- i) Communicate the contents of this HASP to project personnel.
- ii) Eliminate unsafe conditions. Efforts must be initiated to identify conditions that can contribute to an incident and to remove exposure to these conditions.
- iii) Utilize the STAR (Stop, Think, Act, and Review) process before beginning any activity/task/job, after an incident, and/or during any unusual circumstances. Stop the activities to think about the task, analyze the task hazards and determine methods to reduce risk, and review the results with affected personnel.
- iv) Revise or develop Job Safety Analysis (JSA) forms for activities. Supervisors and affected personnel are responsible for JSA development.
- v) Complete Behavioral-Based Safety (BBS) observations via the use of the Safe Task Evaluation Process (STEP).
- vi) Reduce unsafe acts [note that 88 percent of all incidents are directly caused by unsafe acts]. Use the CRA BBS tools (STEPs, JSAs, STAR process, etc.) to reduce the number of unsafe acts]. Personnel shall make a conscious effort to work

safely. A high degree of safety awareness must be maintained so safety factors become an integral part of the task. Supervisory personnel shall ensure that personnel committing unsafe acts are held accountable via counseling, mentoring, and, if necessary, reprimand.

- vii) Inspect frequently. Regular documented safety inspections of the work site, materials, and equipment by qualified persons ensures early detection of unsafe conditions. Safety and health deficiencies shall be corrected as soon as possible or project activities shall be suspended. Documentation of daily inspections and corrective actions should be kept with the project files.

## **1.2        STOP WORK AUTHORITY**

All project personnel are empowered and expected to stop their work, the work of co-workers, subcontractors, client personnel, or other contractors if any person's safety or the environment is at risk. No repercussions will result from this action. Reporting of unsafe condition/acts and/or Stop Work Authority (SWA) shall be documented using the Unsafe Condition/Acts and SWA form, which is located in Appendix A (Project Safety Forms).

The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated shall result in the removal of project personnel from that area and re-evaluation of the hazard and the levels of protection.

## **1.3        PERSONNEL REQUIREMENTS**

All personnel conducting activities on Site must conduct their activities in compliance with all applicable Safety and Health legislation throughout North America to include, but not limited to the Occupational Safety and Health Administration (OSHA) 29 CFR 1910, 29 CFR 1926 and CRA's policies and procedures. Project personnel must also be familiar with the procedures and requirements of this HASP. In the event of conflicting safety procedures/requirements, personnel must implement those safety practices affording the highest level of safety and protection.

## **1.4        SHORT SERVICE EMPLOYEES**

CRA Employees identified, as Short Service Employees (SSE) (6 months or less) shall not be permitted to work without another non-SSE employee present.

## 1.5 PROJECT ORGANIZATION

All personnel conducting activities on Site must conduct their activities in compliance with all applicable OSHA Safety and Health standards including but not limited to the 29 CFR 1910, 29 CFR 1926, and CRA policies and procedures. Project personnel must also be familiar with the procedures and requirements of this HASP and the applicable procedures found within the CRA Safety and Health Policy Manual. In the event of conflicting safety procedures/requirements, personnel must implement those safety practices, which afford the highest level of safety and protection.

### ***CRA PROJECT MANAGEMENT AND SAFETY ORGANIZATION***

#### ***Project Manager CRA – Greg Carli***

The CRA project manager (PM) shall be responsible for the overall implementation of the HASP, and for ensuring that all health and safety responsibilities are carried out in conjunction with this project. This shall include, but is not limited to, review and approval of the HASP; thoroughly investigate any accident that occurs at the Site; qualifying/directing subcontractors relative to safety and health performance; coordinating all safety and health submittals; providing the appropriate technical information to write submittals; and consultation with the Client/Owner regarding appropriate changes to the HASP.

#### ***Safety & Health Officer (SHO) CRA – Jon Valentine***

The SHO is the person who, under the supervision of the PM and the Regional Safety and Health Manager (RSHM), shall be responsible for the communication of all safety requirements to project personnel and subcontractors. The SHO will have prior experience in working at hazardous waste sites and is responsible for carrying out the health and safety responsibilities by making sure that:

- i) The SHO is on-Site at all times during the project work activities.
- ii) All necessary clean up and maintenance of safety equipment is conducted by project personnel.
- iii) Emergency services are contacted.
- iv) The Hazard Communication (HAZCOM) program is maintained on Site.
- v) Forms attached to the HASP are completed correctly, submitted on a timely basis and then properly filed.
- vi) A pre-entry briefing is conducted, which will serve to familiarize project personnel with the procedures, requirements, and provisions of this HASP.

- vii) All necessary records are maintained in the project files (i.e., air monitoring results, calibration log sheets, incident reports, daily safety meeting forms, daily safety logbook entries, training files, etc.)
- viii) Daily safety meetings are held and documented by the SHO.
- ix) Safe work practices for project personnel are enforced.
- x) Safety of any visitors who enter the Site is ensured.
- xi) Communication is maintained with the Client Representatives.
- xii) Orders the immediate shutdown of project activities in the case of a medical emergency, unsafe condition, or unsafe practice.
- xiii) Designate work areas and define minimum PPE requirements.
- xiv) Provide the safety equipment, personal protective equipment, and other items necessary for CRA project personnel.
- xv) Enforce the use of required PPE, any additional safety equipment that is determined to be required and other items necessary for CRA personnel or subcontractor safety.
- xvi) Report safety and health concerns to CRA management as necessary.

***Emergency Coordinator (EC) CRA – Jon Valentine***

The SHO and/or his or her designee will act as the EC. The EC shall be able to implement the emergency procedures and is responsible for the following in the event of an emergency:

- i) The EC shall immediately respond to all imminent or actual emergency situation.
- ii) The EC shall notify all personnel and emergency response agencies, identify the problem, assess the health or environmental hazards, and take all reasonable measures to stabilize the situation.
- iii) The EC must take all reasonable measures necessary to ensure that fire, explosion, emission or discharge does not occur, re-occur, or spread. These measures may include stopping operations.
- iv) The EC shall develop Emergency Evacuation Routes on a daily bases and communicate them to all project personnel.
- v) The EC shall also be responsible for follow-up activities after the incident such as cleanup of the affected area, maintenance, and decontamination of the emergency equipment, and submission of any reports.

### ***Site Supervisor (SS) CRA – Jon Valentine***

Health and safety is a line management responsibility, and as such, the Site Supervisor (SS) will implement the overall on-Site direction and enforcement of the health and safety for this project. The SS will be designated as the "competent person" as per OSHA regulations. The SS will report to the PM for this project.

The SS is the person who, under the supervision of the PM, shall be responsible for the overall implementation of the HASP, communication of the project requirements to all personnel, including subcontractors and visitors and is responsible for carrying out the health and safety responsibilities by making sure that:

- i) All underground utilities have been properly located prior to initiating work activities.
- ii) CRA's Property Access and Utility Locate form has been completed prior to initiating intrusive work.
- iii) All necessary cleanup and maintenance of safety equipment is conducted by project personnel.
- iv) JSA forms are developed, reviewed, and revised accordingly.
- v) Project personnel are implementing the STAR process before initiating activities.
- vi) Forms attached to the HASP are completed, filed, and submitted correctly.
- vii) A pre-entry briefing is conducted and documented, which will serve to familiarize on-Site personnel with the procedures, requirements, and provisions of this HASP.
- viii) Safe work practices are enforced.
- ix) Personnel are observed for any ill affects, especially those symptoms caused by heat stress or chemical exposure.
- x) Project activities are immediately shut down in the case of a medical emergency, unsafe condition, or unsafe practice.
- xi) Job site inspections are conducted as a part of quality assurance for safety and health.
- xii) Safety and health concerns are reported to project management as necessary.

### ***Regional Safety & Health Manager (RSHM) CRA – Craig Gebhardt***

The RSHM is a CRA employee who is trained as a health and safety professional, works full-time for CRA in a health and safety role, and who serves in a consulting role to the PM, SHO, and SS regarding potential health and safety issues. The RSHM is responsible for the technical and safety aspects of the project, including review and approval of subcontractor HASPs.

### ***Personnel Safety Responsibility***

CRA personnel are responsible for their own safety as well as the safety of those around them. CRA personnel shall use any equipment provided in a safe and responsible manner, as directed by their supervisor and will also follow the policies set forth in this HASP and the CRA Safety and Health Program.

Personnel are directed to take the following actions when appropriate:

- i) Utilize the STAR process before initiating work.
- ii) Assist in the development/revision of JSA forms that are appropriate to their current scope of work.
- iii) Suspend any operations, which may cause an imminent health hazard to all project personnel.
- iv) Inspect tools and other equipment before each use or as manufacturer and/or OSHA dictates.
- v) Correct job site hazards when possible to do so, without endangering life or health.
- vi) Report safety and health concerns to the SHO and/or SS.

### ***Subcontractors***

Any selected subcontractor(s), if needed, will be responsible for providing both a Site Supervisor ("competent person") and a SHO to direct their activities and to meet all applicable OSHA Regulations. This may be the same individual if so qualified. These individuals will be responsible for ensuring that all contract specifications are met, including those related to Site health and safety. The names of these individuals will be presented in the subcontractor Site-specific HASP.

All subcontractor personnel working at the Site will report to the CRA SS and in keeping with OSHA requirements are required to comply with all procedures referenced in this HASP, the subcontractor HASP, and the OSHA Construction Standards as referenced in 29 CFR 1926.

Subcontractors working for CRA shall prepare and implement their own Site specific HASP for their contract work and provide all applicable Health and Safety SOPs and/or Safety Programs for use by their Site personnel. The subcontractor's HASP shall meet the minimum requirements of this HASP. CRA will review the subcontractor HASP prior to subcontractor mobilization to the Site. Subcontractors will be responsible for the health and safety of their personnel, which includes following all applicable OSHA



Regulations and the subcontractors' Site-specific HASP. Subcontractors will be required to attend an initial Site briefing put on by CRA and subsequent safety meetings.

*Authorized Visitors*

Authorized Visitors shall be provided with all known information with respect to the project operations and hazards, as applicable to the purpose of their visit.

## **2.0      SITE CHARACTERIZATION AND POTENTIALLY HAZARDOUS COMPOUNDS**

### **2.1      SITE BACKGROUND**

The 12th Street Landfill was in operation from approximately 1955 to 1981. The paper residuals from the wastewater treatment plant of the nearby former Plainwell Mill were placed into a topographically low area within the current landfill footprint. Prior to placement in the landfill, the wastewater effluent sludge was dewatered 'for several months' in lagoons located at the former Plainwell Mill.

It is understood that the paper sludge residuals were apparently transported onto the adjacent areas around the landfill Site. The mechanism of the paper sludge transportation has not been discussed in the available documents. Between 1955 and 1961, a retaining berm was constructed at the landfill to prevent sludge from the Site entering into the Kalamazoo River. Between 1974 and 1980, the berm was increased in thickness and extended around the entire perimeter of the landfill, except the landfill's southern side (adjacent to 12th Street). The material used in making the berm is reported to have been sand, coal fly ash and paper residuals. In 1984, the 12th Street Landfill was covered with soil and seeded. The landfill ranges in elevation from approximately 702 ft above mean sea level (AMSL) near the toe of its northern slope to 734 ft AMSL near 12th Street to the south. The existing landfill side slopes are 2H:1V or slightly steeper except along the river's edge where the slope was reconstructed at 5H:1V in 2007. The reconstruction of this eastern side slope was conducted as an Emergency Response Action to prevent any future potential for paper residual transportation to the Kalamazoo River.

A list of potentially hazardous compounds and detected concentrations of compounds of concern in Site soils, waste, and groundwater is shown in Table 2.1.

### **2.2      REMEDIAL AND MONITORING SYSTEMS DESCRIPTIONS**

The remedial and monitoring systems currently being operated at the Site include:

- i)      Landfill cover
- ii)     Erosion control system
- iii)    Passive gas management system
- iv)    River monitoring system
- v)     Groundwater monitoring well network
- vi)    Landfill gas monitoring system

The monitoring systems are briefly described in the following sections.

### **2.2.1      LANDFILL COVER**

The landfill cover was designed to meet the requirements of the Record of Decision (ROD) and the relevant portions of the current State of Michigan Solid Waste Management Act, Part 115 of the NREPA, 1994, Act 451, as amended (Part 115).

The landfill cover meets the requirements of Rule R299.4425(5) of Part 115, which allows for an alternative landfill cover design if the alternative landfill cover includes (a) an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in Sub rule (3), and (b) an erosion layer that provides equivalent protection from wind and water erosion as the erosion layer specified in Rule R299.4425(3).

The landfill cover consists of the following layers, from the bottom up:

- A fill layer consisting of 6 inches of select granular fill with a hydraulic conductivity of  $1.0 \times 10^{-2}$  cm/s
- A barrier layer consisting of 40-millimeter (mil) linear low-density polyethylene (LLDPE) geomembrane with a hydraulic conductivity layer of  $4.0 \times 10^{-13}$  cm/s
- A conveyance layer consisting of geocomposite drainage material (geonet), placed directly above the 40-mil LLDPE liner
- A fill layer consisting of 24-inch thick general fill
- A vegetative layer consisting of a 6-inch thick topsoil layer

The top of paper residual grades and landfill cover grades are shown on Drawing C-05–Subgrade Contour Plan and Drawing C-07–Final Contour Report in Appendix B of the OM&M Plan. The top area of the landfill has a minimum slope of 5 percent and a maximum slope of 4H:1V.

### **2.2.2      EROSION CONTROL SYSTEM**

In accordance with the ROD, following the installation of the liner cover system (LLDPE geomembrane liner, geonet, and fill layer), an erosion control system consisting of a combination of riprap and a turf reinforcement mat was installed on the eastern side of the landfill adjacent to the Kalamazoo River. The Riverbank from approximately 698.0 to 702.5 above mean sea level (AMSL) was regraded to a 3H:1V slope and covered by riprap

over a geotextile fabric. Upslope of the riprap, 6 inches of topsoil was placed across the bench at approximately 703.0 AMSL. From 702.5 to 707.0 AMSL, on the regraded 5H:1V sideslope, 6 inches of general fill material was installed on the eastern sideslope, overlain by 6 inches of topsoil. The topsoil was then covered with erosion control matting (Enkamat®). The erosion control matting can be characterized by a three-dimensional nylon turf reinforcement mat made of nylon filaments joined at intersections.

In order to control erosion on the west side of the landfill, surface water runoff will be redirected by a combined access road/drainage ditch that discharges into the on-Site wetland to the north. Surface water runoff on the southern side of the landfill will be diverted to the east through a shallow ditch that directs runoff to the Kalamazoo River for discharge. Surface water on the northern side of the landfill will be allowed to sheet flow off the cover system into a combined shallow ditch/access road that has V-notches along the outside of the ditch that enable collected surface water to discharge to the adjacent wetland to the north. The overall Site drainage and erosion control system is detailed on Drawing C-03–Soil Erosion and Sediment Control Plan in Appendix B of the OM&M Plan. In addition, there are specific details for the perimeter drainage swales and drainage outlets presented on Drawing C-11, Details 5 through 8 in Appendix B of the OM&M Plan. The location of the riprap and the turf reinforcement mat is shown on Figure 2.1.

### **2.2.3      SITE ACCESS CONTROLS**

Fencing, gates, locks, signs, and permanent markers have been installed to restrict access to the landfill. The locations of the access controls are shown on Figure 2.2.

### **2.2.4      PASSIVE GAS MANAGEMENT SYSTEM**

In accordance with the ROD, the need for a gas management system was evaluated, and it was determined that it was necessary to vent landfill gas generated by the 12th Street Landfill. A passive gas system has been installed as part of the RA. The passive gas management system consists of the following components:

- A 6-inch select granular fill layer that has been installed on the top of the paper residuals (beneath the liner)
- A series of 11 passive gas vent locations, spaced approximately 200 feet apart across the surface of the landfill footprint, installed within the granular venting layer via a gravel pad at each gas vent location
- Each passive gas vent consists of 4-inch diameter "L-shaped" polyvinyl chloride (PVC) schedule 40 riser pipes penetrating through the landfill cover system

(including boots through the liner) to vent any collected gas directly to the atmosphere

The passive gas management system is shown on As-Built Drawing C-03 in Appendix B of the OM&M Plan.

#### **2.2.5 RIVER WATER MONITORING SYSTEM**

A staff gauge was installed proximal to the northeast corner of the 12th Street Landfill. The staff gauge, SG-101, will be used to measure the water level of the Kalamazoo River. The staff gauge has been installed along the river bank in a location so that river stage can be measured during relatively low river flows.

#### **2.2.6 GROUNDWATER MONITORING WELL NETWORK**

In accordance with the requirements of the ROD, a groundwater monitoring network consisting of 15 overburden monitoring wells has been installed around the perimeter of the landfill. Based on Site conditions and results obtained from the verification aquifer sampling during installation, six monitoring well pairs, consisting of a shallow groundwater monitoring well and a deep groundwater monitoring well, have been installed along the border of the landfill footprint. Two of the monitoring well pairs were installed at upgradient locations, with the other four monitoring well pair locations installed along the downgradient edges of the property. The remaining three monitoring wells consist of single well locations screened below the water table. The monitoring wells along the northern boundary of the landfill have been installed at approximately 200 feet on center.

#### **2.2.7 GAS MONITORING SYSTEM**

In accordance with the ROD, a gas monitoring system consisting of three gas probes has been installed around the southern boundaries of the landfill footprint. Two gas probes have been installed as shallow monitoring locations (GP-1 and GP-3) and one gas probe (GP-2) has been installed as a deeper monitoring location. The shallow gas probes are installed to a depth of 4 to 5 feet below ground surface (bgs) with a 2-foot slotted pipe, and the deep gas probe is installed to a depth of approximately 30 feet bgs with a 25-foot slotted pipe. Gas probes have been constructed using a stopcock and hose barb assembly with a 1/2-inch PVC ball valve and a 1/2-inch threaded connector. Gas probe assemblies are

contained at each location with a standard lockable well casing. Gas probe locations are presented on As-Built Drawing C-03 of the OM&M Plan.

## **2.3 SCOPE OF WORK**

This section describes the operation and maintenance activities for the 12th Street Landfill.

### **2.3.1 LANDFILL COVER**

The landfill cover and adjacent areas disturbed and re-vegetated during construction, will be visually inspected on a quarterly basis for the presence of adequate vegetation, and evidence of erosion or subsidence that could lead to surface water ponding and burrowing by animals. Needed repairs will be noted by OM&M personnel on a Site inspection form and reported to a representative of Weyerhaeuser. Repairs will be completed within 30 days of discovery, weather and Site conditions permitting. In addition, the vegetative cover will be maintained as necessary to prevent the growth of woody plants. The inspection frequency will be reduced to semiannually after 2 years.

### **2.3.2 EROSION CONTROL SYSTEM**

The riprap, the erosion control matting, and vegetation below elevation 707 feet AMSL will be visually inspected quarterly for the presence of an adequate amount of riprap (no exposed geotextile), possible movement of the riprap, the presence of adequate and thriving vegetation, evidence of erosion or rutting, and signs of burrowing animals. Needed repairs will be noted by OM&M personnel on a Site inspection form and reported to a representative of Weyerhaeuser. During the erosion control system inspections, the perimeter drainage swales and outlets will be inspected to determine maintenance activities, which may include, but are not limited to, the removal of sediment that have collected in the sealed and outlets. Repairs to the erosion control system or maintenance of the swales or outlets will be completed within 30 days of discovery, weather and Site conditions permitting. In addition, the vegetative cover below 707 feet AMSL, along the Kalamazoo River, will be maintained as necessary to prevent the growth of woody plants. The inspection frequency will be reduced to semiannually after 2 years.

### **2.3.3 SITE ACCESS CONTROLS**

Fencing, gates, and locks will be inspected quarterly for signs of vandalism, deterioration, or damage. Needed repairs will be noted by OM&M personnel on a Site inspection form

and reported to a representative of Weyerhaeuser. Repairs will be completed within 30 days of discovery, weather and Site conditions permitting. The inspection frequency will be reduced to semiannually after 2 years.

#### **2.3.4      GAS VENTS**

Gas vents will be inspected quarterly for structural integrity and identification labels. Needed repairs to the vents will be noted by OM&M personnel on a Site inspection form and reported to a representative of Weyerhaeuser. Repairs will be completed within 30 days of discovery, weather and Site conditions permitting. A description of potential contingency actions for the gas venting system is provided in the following section. The inspection frequency will be reduced to semiannually after 2 years.

#### **2.3.5      GAS PROBES**

The gas probes will be inspected quarterly for structural integrity, the presence and the condition of locks, and identification labels. Needed repairs to the gas probes will be noted by OM&M personnel on a Site inspection form and reported to a representative of Weyerhaeuser. Repairs will be completed within 30 days of discovery, weather and Site conditions permitting. If combustible gas (measured as a percentage by volume) is detected further actions as outlined in the OM&M Plan may be taken.

#### **2.3.6      GROUNDWATER MONITORING WELL MAINTENANCE**

The groundwater monitoring wells will be inspected quarterly for structural integrity and the presence and condition of locks and identification labels. Needed repairs to the groundwater monitoring wells will be noted by OM&M personnel on a Site inspection report and reported to a representative of Weyerhaeuser. Repairs will be completed within 30 days of discovery, weather and Site conditions permitting. A contingency plan has been developed in the event that a change occurs that reduces or limits the effectiveness of the remedial action in protecting human health and the environment. The need to undertake contingency response actions will be based on the specific situation encountered and on relevant information available at the time as discussed in the OM&M Plan.

### **2.3.7      GROUNDWATER MONITORING PROGRAM**

Groundwater monitoring is to be conducted in accordance with the FSP and the results compared to the State of Michigan Part 201 groundwater surface water interface (GSI) criteria (included in Table 4.1 in the PSVP of the Final Design Report, Appendix D) and the Toxic Substances Control Act (TSCA) (40 CFR Section 761.75[b] [6], which describes the monitoring system requirements for chemical waste landfills). The long-term groundwater monitoring program requires groundwater monitoring on a quarterly basis for the first 2 years following installation of the groundwater monitoring wells. Water levels will be recorded a minimum of three times per week for the two weeks preceding the groundwater sampling event. Water levels will be measured in the monitoring wells and the River staff gauge to verify that flow is toward the River. Each year of monitoring is to include two semiannual monitoring events and two quarterly monitoring events. Each monitoring event will include confirmatory monitoring the day of the event to verify water levels are indicative of flow towards the Kalamazoo River. Groundwater sampling will begin with samples taken from wells that are closest to the River to reduce the influence on flow across the landfill footprint. Sampling order may change based on the results from the first sampling event. To prevent cross-contamination, wells that exhibit the highest concentrations of laboratory analytes will be sampled last. The proximity of each well to the River will be incorporated into this protocol. The field procedures that will be used for groundwater monitoring will be performed in accordance with SOP F-11, provided in Appendix D of the OM&M Plan. The OM&M Plan describes the groundwater activities that will characterize the long-term groundwater monitoring program on a quarterly and semiannual basis.



### 3.0 **BASIS FOR DESIGN**

Regulations set forth by OSHA in Title 29, CFR, Parts 1910 and 1926 (29 CFR 1910 and 1926) form the basis of this HASP. Emphasis is placed on Section 1926.65 (Hazardous Waste Operations and Emergency Response), 1910 Subpart I (Personal Protective Equipment), 1910 Subpart Z (Toxic and Hazardous Substances), 1926 Subpart O (Motor Vehicles, Mechanized Equipment, and Marine Operations), and 1926 Subpart F (Excavations). Some of the specifications within this section are in addition to the OSHA regulations, and reflect the positions of the United States Environmental Protection Agency (USEPA), the National Institute for Occupational Safety and Health (NIOSH), and the United States Coast Guard (USCG) regarding safe operating procedures at hazardous waste sites.

This HASP follows the guidelines established in the following:

- i) *Standard Operating Safety Guides*, USEPA (Publications 9285.1-03, June 1992)
- ii) *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, OSHA, USCG, USEPA (86-116), October 1985)
- iii) Title 29 of the CFR, Part 1926.65
- iv) Title 29 of the CFR, Part 1926
- v) *Pocket Guide to Chemical Hazards*, DHHS, PHS, CDC, NIOSH (1997)
- vi) *Threshold Limit Values*, ACGIH (1998-1999)
- vii) *Quick Selection Guide to Chemical Protective Clothing*, Forsberg, K. and S.Z. Mandsorf, 2nd Ed. (1993)

The health and safety of the public and project personnel and the protection of the environment will take precedence over cost and scheduling considerations for all project work.

### 3.1 **DEFINITIONS**

The following definitions are applicable to this HASP:

- i) *Site* - the area where the work is to be performed
- ii) *Project* - all on-Site work performed under the scope of work
- iii) *On-Site Personnel* - all client personnel, contractors, and subcontractor personnel involved with the project

- iv) *Visitor* - all other personnel, except the on-Site personnel. All visitors must receive approval to enter the Site
- v) *Temporary Exclusion Zone (TEZ)* - any portion of the Site where hazardous substances are, or are reasonably expected to be, present in the air, water, waste materials or soil
- vi) *Contamination Reduction Zone (CRZ)* - area between the EZ and Support Zone (SZ) that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone
- vii) *Support Zone (SZ)* - the rest of the Site where exposure to hazardous substances is not anticipated. Support equipment is located in this zone

## **4.0 PERSONAL PROTECTIVE EQUIPMENT**

PPE is required to safeguard project personnel from various hazards. Varying levels of protection may be required depending on the level of contaminants and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level.

### **4.1 LEVELS OF PROTECTION**

Protection levels are determined based upon contaminants present in the work area. The specific protection levels to be employed at the Site for each work task are presented in each JSA form, which are found in Appendix C. The sections presented below provide additional information on the specific PPE that will be worn during the project activities.

#### **4.1.1 LEVEL D PROTECTION**

The minimum level of protection that will be required for all project personnel working at the Site will be Level D. The following equipment will be worn:

- i) Work clothing as prescribed by the weather
- ii) Steel toe work boots, meeting American National Standard Institute (ANSI) Z41
- iii) Safety glasses or goggles, meeting ANSI Z87
- iv) Reflective safety vest when working near heavy equipment
- v) Hard hat, meeting ANSI Z89
- viii) Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)

#### **4.1.2 MODIFIED LEVEL D PROTECTION**

Modified Level D will be worn when airborne contaminants are not present at levels of concern, but project activities present an increased potential for skin contact with hazardous materials, such as during drilling and sampling activities. Modified Level D consists of:

- i) Tyvek® coveralls
- ii) safety toe work boots
- iii) disposable latex or neoprene overboots
- iv) safety glasses or goggles
- v) hard hat
- i) face shield in addition to safety glasses or goggles when projectiles pose a hazard
- ii) reflective safety vest when working near heavy equipment
- viii) nitrile gloves
- ix) hearing protection (as necessary)

#### **4.1.3      SELECTION OF PPE**

Equipment for personal protection will be selected based on the potential for contact, current conditions at the Site, and the judgment of the PM, SHO, SS and the RSHM. The PPE used will be chosen to be effective against the contaminants of concern present at the Site.

#### **4.2          USING PPE**

Depending upon the level of protection selected for this project, specific donning and doffing procedures may be required.

All personnel entering the Exclusion Zone (EZ) must put on the required PPE in accordance with the requirements of this plan. When leaving the EZ, PPE will be removed in accordance with the procedures listed, to minimize the spread of contamination.

#### **4.3          SELECTION MATRIX**

The level of personal protection selected will be based upon real time air monitoring of the work environment and an assessment by the SS and/or SHO of the potential for skin contact with contaminated materials. The PPE selection matrix is presented on each JSA form, which is presented in Appendix C. This matrix is based upon the information that is available at the time this plan was written. The exposure levels presented in Table 2.2 should be used to verify that the PPE prescribed is appropriate.

#### **4.4        DURATION OF WORK TASKS**

The duration of activities involving the usage of PPE will be established by the SHO based upon ambient temperature and weather conditions, the capacity of personnel to work in the designated level of PPE (heat stress, see Section 6.2) and limitations of the protective equipment (i.e., ensemble permeation rates, life expectancy of the APR cartridges, etc.) As a minimum, rest breaks will be observed at the following intervals:

- i)       Fifteen minutes midway between shift start-up and lunch
- ii)      One-half to one hour for lunch
- iii)     Fifteen minutes in the afternoon, between lunch, and shift end

All rest breaks will be taken in the clean area (Support Zone [SZ]) after full decontamination and PPE removal. Additional rest breaks will be observed based upon the heat stress monitoring guidelines presented in Section 5.1.14.

#### **4.5        LIMITATIONS OF PROTECTIVE CLOTHING**

PPE ensembles have been selected to provide protection against contaminants at anticipated concentrations in the groundwater. However, no protective garment, glove, or boot is chemical-proof, nor will it afford protection against all chemical types. Permeation of a given chemical through PPE is a complex process governed by contaminant concentrations, environmental conditions, physical condition of the protection garment, and the resistance of a garment to a specific contaminant; chemical permeation may continue even after the source of contamination has been removed from the garment.

In order to obtain optimum usage from PPE, the following procedures are to be followed by all project personnel using PPE:

- i)       When using disposable coveralls, don a clean, new garment after each rest break or at the beginning of each shift
- ii)      Inspect all clothing, gloves, and boots both prior to and during use for:
  - a)       Imperfect seams
  - b)       Non-uniform coatings
  - c)       Tears
  - d)       Poorly functioning closures

- iii) Inspect reusable garments, boots, and gloves both prior to and during use for:
  - a) Visible signs of chemical permeation
  - b) Swelling
  - c) Discoloration
  - d) Stiffness
  - e) Brittleness
  - f) Cracks
  - g) Any sign of puncture
  - h) Any sign of abrasion

Reusable gloves, boots, or coveralls exhibiting any of the characteristics listed above will be discarded. PPE used in areas known or suspected to exhibit elevated concentrations of contaminants will not be reused.

## **5.0 PROJECT HAZARDS AND CONTROL MEASURES**

This section identifies the general hazards associated with specific activities and presents the documented or potential health and safety hazards that exist at the Site. Every effort will be made to reduce or eliminate these hazards. Those which cannot be eliminated must be guarded against by use of engineering controls and/or PPE.

A JSA identifies potential safety, health, and environmental hazards associated with each type of field activity. A JSA shall be developed for each work activity that will be performed at the Site. Appendix C presents JSAs for the known activities that will take place at the Site. Because of the complex and changing nature of field projects, supervisors must continually inspect the work site to identify hazards that may harm project personnel, the community, or the environment. The SS or SHO must be aware of these changing conditions and discuss them with the RSHM and the PM whenever these changes impact project personnel health, safety, the environment, or performance of the project. The SS or SHO will keep all personnel informed of the changing conditions and will write or approve addenda or revisions to this HASP as necessary.

### **5.1 FIELD ACTIVITIES, HAZARDS, CONTROL PROCEDURES**

#### **5.1.1 FIELD SAMPLING ACTIVITIES**

Field sampling operations consist of landfill gas and groundwater samples for subsequent analysis and evaluation of potential Site contamination. The physical hazards of these operations are primarily associated with the sample collection methods and procedures utilized.

Inhalation and absorption (contact) of contaminants are the primary routes of entry associated with groundwater sampling due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. To control dermal exposure during groundwater sampling activities, a minimum of Modified Level D protection will be worn. Air sampling may be conducted during groundwater sampling to assess the potential for exposure to airborne contaminants.

#### **5.1.2 CHEMICAL HAZARDS**

Preventing exposure to toxic chemicals is a primary concern. Chemical substances can enter the unprotected body by inhalation, skin absorption, ingestion, or through a

puncture wound (injection). A contaminant can cause damage at the point of contact or can act systematically, causing a toxic effect at a part of the body distant from the point of initial contact.

Chemical exposures are generally divided into two categories: acute and chronic. Symptoms resulting from acute exposures usually occur during or shortly after exposure to a sufficiently high concentration of a contaminant. The concentration required to produce such effects varies widely from chemical to chemical. The term "chronic exposure" generally refers to exposures to "low" concentrations of a contaminant over a long period of time. The "low" concentrations required to produce symptoms of chronic exposure depend upon the chemical, the duration of each exposure, and the number of exposures. For a given contaminant, the symptoms of an acute exposure may be completely different from those resulting from chronic exposure.

For either chronic or acute exposure, the toxic effect may be temporary and reversible, or may be permanent (disability or death). Some chemicals may cause obvious symptoms such as burning, coughing, nausea, tearing eyes, or rashes. Other chemicals may cause health damage without any such warning signs (this is a particular concern for chronic exposures to low concentrations). Health effects such as cancer or respiratory disease may not be manifested for several years or decades after exposure. In addition, some toxic chemicals may be colorless and/or odorless, may dull the sense of smell, or may not produce any immediate or obvious physiological sensations. Thus, a worker's senses or feelings cannot be relied upon in all cases to warn of potential toxic exposure.

The effects of exposure not only depend on the chemical, its concentration, route of entry, and duration of exposure, but may also be influenced by personal factors such as the individual's smoking habits, alcohol consumption, medication use, nutrition, age, and sex.

Direct contact of the skin and eyes by hazardous substances is an important route of exposure. Some chemicals directly injure the skin. Some pass through the skin into the bloodstream where they are transported to vulnerable organs. Skin absorption is enhanced by abrasions, cuts, heat, and moisture. The eye is particularly vulnerable because airborne chemicals can dissolve in its moist surface and be carried to the rest of the body through the bloodstream (capillaries are very close to the surface of the eye). Wearing protective equipment, not using contact lenses in contaminated atmospheres (since they may trap chemicals against the eye surface), keeping hands away from the face, and minimizing contact with liquid and solid chemicals can help protect against skin and eye contact.



Although ingestion should be the least significant route of exposure at the Site, it is important to be aware of how this type of exposure can occur. Deliberate ingestion of chemicals is unlikely, however, personal habits such as chewing gum or tobacco, drinking, eating, smoking cigarettes, and applying cosmetics at the Site may provide a route of entry for chemicals.

The last primary route of chemical exposure is injection, whereby chemicals are introduced into the body through puncture wounds (i.e., by stepping or tripping and falling onto contaminated sharp objects). Wearing safety shoes, avoiding physical hazards, and taking common sense precautions are important protective measures against injection.

### **5.1.3      MANUAL LIFTING**

When lifting objects, use the following proper lifting techniques:

- i) Feet must be parted, with one foot alongside the object being lifted and one foot behind. When the feet are comfortably spread, a more stable lift can occur and the rear foot is in a better position for the upward thrust of the lift.
- ii) Do not lift more than 50 pounds without the assistance of another individual.
- iii) Use the squat position and keep the back straight - but remember that straight does not mean vertical. A straight back keeps the spine, back muscles, and organs of the body in correct alignment. It minimizes the compression of the guts that can cause a hernia.
- iv) Grip is one of the most important elements of correct lifting. The fingers and the hand are extended around the object you're going to lift - using the full palm. Fingers have very little power - use the strength of your entire hand.
- v) The load must be drawn close, and the arms and elbows must be tucked into the side of the body. Holding the arms away from the body increases the strain on the arms and elbows. Keeping the arms tucked in helps keep the body weight centered.
- vi) The body must be positioned so that the weight of the body is centered over the feet. This provides a more powerful line of thrust and also ensures better balance. Start the lift with a thrust of the rear foot. Do not twist your back while lifting or moving objects.

#### **5.1.4      HAND AND POWER TOOLS**

##### ***Hand Tools***

- i) Hand tools must meet the manufacturer's safety standards.
- ii) Hand tools must not be altered in any way.
- iii) At a minimum, eye protection must be used when working with hand tools.
- iv) Wrenches (including adjustable, pipe, end, and socket wrenches) must not be used when jaws are sprung to the point that slippage occurs.
- v) Impact tools (such as drift pins, wedges, and chisels) must be kept free of mushroom heads.
- vi) Wooden handles must be free of splinters or cracks and secured tightly to the tool.

##### ***Power Tools***

- i) All power tools must be inspected regularly and used in accordance with the manufacturer's instructions and the tool's capabilities.
- ii) Electric tools must not be used in areas subject to fire or explosion hazards, unless they are approved for that purpose.
- iii) Portable electric tools must be connected to a Ground Fault Circuit Interrupter (GFCI) when working in wet areas.
- iv) Proper eye protection must be used when working with power tools.
- v) Personnel must be trained in the proper use of each specific tool.
- vi) Any damaged or defective power tools must be immediately tagged and removed from service.

#### **5.1.5      ELECTRICAL HAZARDS**

Electricity may pose a particular hazard to project personnel due to the use of portable electrical equipment. When electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements include:

- i) All electrical wiring and equipment must be a type listed by Underwriters Laboratory (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.

- ii) All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or United States Coast Guard regulations.
- iii) A multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle must ground portable and semi-portable tools and equipment.
- iv) Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools must be distinctly marked and listed by UL or FM.
- v) Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.
- vi) Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching
- vii) All circuits must be protected from overload
- viii) Temporary power lines, switch boxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.
- ix) Plugs and receptacles must be kept out of water unless of an approved submersible construction.
- x) All extension outlets must be equipped with ground fault circuit interrupters (GFCIs).
- xi) Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.
- xii) Extension cords or cables must be inspected prior to each use, and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.
- xiii) Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

#### **5.1.6 FALL HAZARDS**

Personnel that will use ladders and have the potential hazard of working on elevated surfaces or platforms of 6 feet or greater during project activities shall follow CRA's Safety and Health Program for fall protection. [The CRA Fall Protection Program can be found on My Portal/Safety & Health/Safety and Health Documents/Safety and Health Policy Manuals/US/Written Safety Programs/Fall Protection]. The fall protection

program includes leading edge work, rooftop work, aerial lifts, ladders, and scaffolds. Specific guidelines for portable ladders are outlined below.

An emergency rescue plan for retrieving any worker who has fallen and is suspended in air shall be written out and communicated to all personnel working on Site prior to individuals wearing personal fall arrest equipment. Time is of the essence to prevent the development of a life threatening condition, such as orthostatic intolerance or suspension trauma, due to being suspended for a period of time. Rescue methods and equipment will be specific to the project Site; however, the following information provides examples of typical rescue methods/equipment:

- i) Scissors lift or articulating boom already on Site.
- ii) Lower/raise worker by an acceptable physical and/or mechanical means (self-rescue not acceptable as primary rescue method).
- iii) A rescue team trained in above ground rescue techniques.
- iv) A rope or cable system to lower employee to ground (requires point of attachment for rigging tackle).
- v) A crane man-basket setup in advance for rescue.

#### **5.1.7 PORTABLE LADDERS**

Employees who use ladders on work sites must be familiar with safe ladder usage. They are as follows:

- i) Use the 4-to-1 ratio. Place the ladder so its feet are 1 foot away from what it leans against for every 4 feet in height to the point where the ladder rests. Example: If the top of a 16-foot ladder leans against a wall, its feet should be placed 4 feet from the wall. The "fireman's method" is a convenient way of checking the angle of the ladder. Place your toes against the base of the ladder; fully extend both arms toward the side rail and parallel to the ground. When standing erect you should be able to hold the ladder's side rails.
- ii) Do not use a ladder in a horizontal position as a runway or a scaffold.
- iii) Do not place a ladder in front of a door that opens toward it unless the door is locked, blocked, or guarded by someone.
- iv) Place a portable ladder so that both side rails have a secure footing. Provide solid footing on soft ground to prevent the ladder from sinking.
- v) Place the ladder's feet on a substantial and level base, not on a movable object.
- vi) On uneven surfaces, use a block, wedge, or ladder foot.

- vii) On wet or oily pavement, a smooth floor, or an icy or metal surface, the ladder footing must be lashed, blocked, or otherwise secured.
- viii) Do not lean a ladder against unsafe backing, such as loose boxes or barrels.
- ix) When using a ladder for access to high places, securely lash or otherwise fasten the ladder to prevent it from slipping.
- x) To gain access to a roof or elevated platform, extend the ladder at least three rungs (3 feet) above the point of support.

#### *Ascending or Descending of Ladders*

- i) Maintain three points of contact at all time when going up or down. If material must be handled, raise or lower it with a rope.
- ii) Always face the ladder when ascending or descending.
- iii) Maintain clean, dry footwear as much as possible to prevent slipping on the rungs.

### **5.1.8      NOISE**

Project activities that include working in close proximity to the air compressor, or heavy equipment and/or drilling operations, or using power tools, that generate noise levels exceeding the decibel range of 85 dBA will require the use of hearing protection with a Noise Reduction Rating (NRR) of at least 20. Hearing protection (earplugs/muffs) will be available to personnel and visitors that would require entry into these areas.

When it is difficult to hear a coworker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All project personnel who may be exposed to high noise levels will participate in CRA's Hearing Conservation Program.

### **5.1.9      UTILITY CLEARANCES**

Elevated superstructures (e.g., drill rigs, back hoes, scaffolding, ladders, cranes) shall remain a distance of 10 feet away from utility lines (<50 kV) and 20 feet away from power lines (>50 kV). Underground utilities, if present, shall be clearly marked and identified prior to commencement of work. Follow local/state/provincial regulations with regards to utility locating requirements (e.g., One-Call, etc.)

Personnel involved in intrusive work shall:

- i) Review and adhere to CRA's Subsurface Utility Clearance Protocol.
- ii) Utilize the Property Access/Utility Clearance Data Sheet found in Appendix A.
- iii) Be able to determine the minimum distance from marked utilities which work can be conducted with the assistance of the locator line service.

#### **5.1.10 SLIP/TRIP/HIT/FALL**

Slip/trip/hit/fall injuries are the most frequent of all injuries to workers. They occur for a wide variety of reasons, but can be minimized by the following prudent practices:

- i) Spot-check the work area to identify hazards.
- ii) Establish and utilize a pathway, which is most free of slip and trip hazards.
- iii) Beware of trip hazards such as wet floors, slippery floors, and uneven surfaces or terrain.
- iv) Carry only loads, which you can see over.
- v) Keep work areas clean and free of clutter, especially in storage rooms and walkways.
- vi) Communicate hazards to on-Site personnel.
- vii) Secure all loose clothing and ties, and remove jewelry while around machinery.
- viii) Report and/or remove hazards.
- ix) Keep a safe buffer zone between workers using equipment and tools.

#### **5.1.11 HEAT STRESS**

##### ***Recognition and Symptoms***

Temperature stress is one of the most common illnesses that project personnel face when working during periods when temperatures and/or humidity are elevated. Acclimatization and frequent rest periods must be established for conducting activities where temperature stress may occur. Below are listed signs and symptoms of heat stress. Personnel should follow appropriate guidelines if any personnel exhibit these symptoms:

<b>Heat Rash</b>	Redness of skin. Frequent rest and change of clothing.
<b>Heat Cramps</b>	Painful muscle spasms in hands, feet, and/or abdomen. Administer lightly salted water by mouth, unless there are medical restrictions.
<b>Heat Exhaustion</b>	Clammy, moist, pale skin, along with dizziness, nausea, rapid pulse, fainting. Remove to cooler area and administer fluids.
<b>Heat Stroke</b>	Hot dry skin; red, spotted or bluish; high body temperature of 104°F; mental confusion; loss of consciousness; convulsions or coma. Immediately cool victim by immersion in cool water. Wrap with wet sheet while fanning, sponge with cool liquid while fanning; treat for shock. <b>DO NOT DELAY TREATMENT. COOL BODY WHILE AWAITING AMBULANCE.</b>

### *Work Practices*

The following procedures will be carried out to reduce heat stress:

- i) Heat stress monitoring.
- ii) Acclimatization.
- iii) Work/rest regimes (schedule of breaks) – mandatory breaks scheduled in summer months or during high risk activities for heat stress.
- iv) Heat stress safety personal protective equipment (cool-vests, bandanas, etc.)
- v) Liquids that replace electrolytes, water, and salty foods available during rest.
- vi) Use of buddy system.

### *Acclimatization*

The level of heat stress at which excessive heat strain will result depends on the heat tolerance capabilities of the worker. Each worker has an upper limit for heat stress beyond which the resulting heat strain can cause the worker to become a heat casualty. In most workers, appropriate repeated exposure to elevated heat stress causes a series of physiologic adaptations called acclimatization, whereby the body becomes more efficient in coping with the heat stress. Work/rest regimes planned as a component of project preparation and discussed during the daily tailgate safety meetings.

### *Worker Information and Training*

All personnel who work in areas where there is a reasonable likelihood of heat injury or illness should be kept informed through continuing education programs (hazards, effects, preventative measures, drug/alcohol interaction, etc.).

#### **5.1.12      SUN EXPOSURE**

Over exposure to sunlight is a common concern when field activities occur during warm weather conditions. Overexposure can occur on clear, sunny days as well as on overcast and cloudy days. Ultraviolet (UV) rays from the sun can cause skin damage or sunburn but can also result in vision problems, allergic reactions, and other skin concerns. Two types of UV rays are emitted from the sun: UVA and UVB rays.

UVB rays cause sunburn, skin cancer, and premature aging of the skin. UVB rays stimulate tanning but are also linked to other problems such as impaired vision, skin rashes, and some allergic and other reactions to certain drugs. Extra care should be taken if activities are to be conducted on or near water. Sunlight reflected off the surface of the water is intensified resulting in accelerated effects. The following steps should be taken to protect against over exposure to sunlight:

- i) Always use sunscreen – Apply a broad-spectrum sunscreen with Sun Protection Factor (SPF) of at least 15 or higher liberally on exposed skin. Reapply every 2 hours or more. Even water proof sunscreen can come off when you towel off or sweat.
- ii) Cover up – Wearing tightly woven, loose-fitting, and full-length clothing is a good way to protect your skin from the sun's UV rays.
- iii) Wear a hat – A hat with a wide brim offers good sun protection to your eyes, ears, face, and the back of your neck – areas particularly prone to overexposure to the sun.
- iv) Wear tinted safety glasses that block 99-100% of UV radiation – Tinted Safety Glasses that provide 99-100% UVA and UVB protection will greatly reduce sun exposure that can lead to cataracts and other eye damage.
- v) Seek shade – Shade is a good source of protection but keep in mind that shade structures (i.e., trees, umbrellas, canopies) do not offer complete sun protection.
- vi) Limit time in the midday sun – The sun's rays are strongest between 10 a.m. and 4 p.m. Whenever possible, limit exposure to the sun during these hours.

#### **5.1.13      COLD STRESS**

Cold stress is similar to heat stress in that it is caused by a number of interacting factors including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Fatal exposures to cold have been reported in individuals failing to escape from low environmental air temperatures or from immersion in low temperature water. Hypothermia, a condition in which the



body's deep core temperature falls significantly below 98.6°F (37°C), can be life threatening. A drop in core temperature to 95°F (35°C) or lower must be prevented.

Air temperature is not sufficient to determine the cold hazard of the work environment. The wind chill must be considered as it contributes to the effective temperature and insulating capabilities of clothing. The equivalent chill temperature should be used when estimating the combined cooling effect of wind and low air temperatures on exposed skin or when determining clothing insulation requirements to maintain the body's core temperature.

The body's physiologic defense against cold includes constriction of the blood vessels, inhibition of the sweat glands to prevent loss of heat via evaporation, glucose production, and involuntary shivering to produce heat by rapid muscle contraction.

The frequency of accidents increases with cold temperature exposures as the body's nerve impulses slow down, individuals react sluggishly, and numb extremities make for increased clumsiness. Additional safety hazards include ice, snow blindness, reflections from snow, and possible skin burns from contact with cold metal.

Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 95°F (35°C). This must be taken as a sign of danger to the individuals on Site, and cold exposures should be immediately terminated for any individual when severe shivering becomes evident. Useful physical or mental work is limited when severe shivering occurs.

### ***Predisposing Factors for Cold Stress***

There are certain predisposing factors that make an individual more susceptible to cold stress. It is the responsibility of the project team members to inform the SHO/SS to monitor an individual, if necessary, or use other means of preventing/reducing the individual's likelihood of experiencing a cold related illness or disorder.

Predisposing factors that will increase an individual's susceptibility to cold stress are listed below:

- i) **Dehydration:** The use of diuretics and/or alcohol, or diarrhea can cause dehydration. Dehydration reduces blood circulation to the extremities.
- ii) **Fatigue during Physical Activity:** Exhaustion reduces the body's ability to constrict blood vessels. This results in the blood circulation occurring closer to the surface of the skin and the rapid loss of body heat.

- iii) **Age:** Some older and very young individuals may have an impaired ability to sense cold.
- iv) **Poor Circulation:** Vasoconstriction of peripheral vessels reduces blood flow to the skin surface.
- v) **Heavy Work Load:** Heavy workloads generate metabolic heat and make an individual perspire even in extremely cold environments. If perspiration is absorbed by the individual's clothing and is in contact with the skin, cooling of the body will occur.
- vi) **The Use of PPE:** PPE usage that traps sweat inside the PPE may increase an individual's susceptibility to cold stress.
- vii) **Lack of Acclimatization:** Acclimatization, the gradual introduction of workers into a cold environment, allows the body to physiologically adjust to cold working conditions.
- viii) **History of Cold Injury:** Previous injury from cold exposures may result in increased cold sensitivity.

### *Prevention of Cold Stress*

There are a variety of measures that can be implemented to prevent or reduce the likelihood of individuals developing cold related ailments and disorders. These include acclimatization, fluid and electrolyte replenishment, eating a well balanced diet, wearing warm clothing, the provision of shelter from the cold, thermal insulation of metal surfaces, adjusting work schedules, and personnel education.

**Acclimatization:** Acclimatization is the gradual introduction of workers into the cold environment to allow their bodies to physiologically adjust to cold working conditions. However, the physiological changes are usually minor and require repeated uncomfortably cold exposures to induce them.

**Fluid and Electrolyte Replenishment:** Cold, dry air can cause individuals to lose significant amounts of water through the skin and lungs. Dehydration affects the flow of blood to the extremities and increases the risk of cold injury. Warm, sweet, caffeine-free, non-alcoholic drinks and soup are good sources to replenish body fluids.

**Eating a Well Balanced Diet:** Restricted diets including low salt diets can deprive the body of elements needed to withstand cold stress. Eat high-energy foods throughout the day.

**Warm Clothing:** It is beneficial to maintain air space between the body and outer layers of clothing in order to retain body heat. However, the insulating effect provided by such air spaces is lost when the skin or clothing is wet.

**Work/Rest Regimes:** Schedule work during the warmest part of the day, if possible. Rotate personnel and adjust the work/rest schedule to enable individuals to recover from the effects of cold stress.

The parts of the body most important to keep warm are the feet, hands, head, and face. As much as 40 percent of body heat can be lost when the head is exposed.

#### **5.1.14      ADVERSE WEATHER CONDITIONS**

The SS shall decide on the continuation or discontinuation of work based on current and pending weather conditions. Electrical storms, heavy rains, hurricanes, tornado warnings, and sustained strong winds (approximately 40 mph) are examples of conditions that would call for the discontinuation of work and evacuation of Site.

In addition, no work with elevated super structures (e.g., drilling, crane operations, etc.) will be permitted during any type of electrical storm or during wind events that have wind speeds exceeding 40 mph.

#### **5.1.15      HOT WORK HAZARDS**

Personnel conducting hot work, including burning, pipe welding, cutting, brazing, grinding, or other activities capable of producing ignition sources, or personnel working in the vicinity of hot work, must adhere to the following practices:

- i) No open flames will be used without prior approval by SS.
- ii) Torches will be equipped with anti-flashback devices.
- iii) Where electrode holders are left unattended, electrodes will be removed and the holders will be replaced so they cannot make electrical contact.
- iv) All arc welding and cutting cables will be completely insulated. There will be no repairs or splices within 10 feet of the electrode holder, except where splices are insulated equal to the insulation of the original cable. Defective cable will be repaired or replaced.
- v) No welding, cutting, or hot work will be conducted on used drums, tanks, or containers until they have been cleaned and purged.
- vi) Only individuals with documented training and work experience in these activities shall conduct hot work.

- vii) At a minimum, a 20-pound ABC-type fire extinguisher and a first-aid kit must be available. When hot work is underway, and for an agreed upon period afterwards, a fire watch must be maintained.
- viii) Personnel involved in the operation shall wear appropriate personal protective equipment specific to the task, such as a welder's helmet with an appropriate eye shade, leather or heavy duty cloth gloves, and coveralls or a long-sleeved shirt and pants to prevent skin exposure, steel toed or safety shoes, hearing protection, etc.
- ix) Appropriate activity segregation equipment, such as welding screens for welding operations, should be erected whenever practical to isolate the hot work from the remainder of the Site activities and Site personnel
- x) The area should be cleared of any flammable and combustible materials before hot work begins.

#### **5.1.16      VEHICLE TRAFFIC AND CONTROL**

The following safety measures are to be taken by CRA personnel that have the potential to be exposed to vehicle traffic:

- i) A high visibility safety vest meeting ANSI Class II garment requirements is to be worn at all times.
- ii) Personnel will work using the "buddy system".
- iii) Cones and other visible markers will be used to demarcate a safe work zone around the active work zone(s).
- iv) Appropriate signage will be posted as necessary, to inform roadway/parking lot users of any additional control measures necessary to protect the public and project personnel.

Additionally, when working on an active public roadway or along the shoulder or side of the road is necessary, project personnel must follow the requirements presented in the Manual on Uniform Traffic Control Devices (MUTCD), which is found at: <http://mutcd.fhwa.dot.gov/kno-millennium.htm>. This will include the implementation of a Temporary Traffic Control Plan (TTCP) and discussion with the local municipality as to the responsible party who will implement the TTCP. The TTCP has four components: The Advanced Warning Area, the Transition Area, the Activity Area, and the Termination Area.

## **5.2            BIOLOGICAL HAZARDS**

Project personnel will be conducting numerous activities that have the possibility of encountering biological hazards, which could include exposure to bloodborne pathogens, insects, spiders, rodents, snakes, and large predators. This section identifies precautions to be taken if these hazards are encountered.

### **5.2.1        VEGETATION OVERGROWTH**

Overgrown weeds, bushes, trees, grass and other vegetation are fire and safety hazards. There are a number of hidden hazards not immediately recognized due to the overgrowth of vegetation in areas where field activities may occur, including discarded junk, litter, and debris. Construction materials such as boards, nails, concrete, and other debris may be hidden beneath blades of tall grass, weeds, and bushes. Other hazards may include steep slopes, potholes, trenches, soft spots, dips, etc., all dangerously concealed from the view of the individual walking or operating motorized equipment in the area. Additionally, there are biological hazards such as snakes, ticks, chiggers, and mosquitoes that breed in overgrowth conditions.

Here are some simple actions you can take:

- i)      Assess the work area and determine if the area requires vegetation clearance. Consider that overgrowth that extends above the lowest level of motorized equipment (i.e., bumper or fender) or 6 inches above your ankle has hidden hazards that you will not be able to readily identify.
- ii)     Determine if the area is safe to walk or whether you need motorized equipment. Consider the limitations of the equipment.
- iii)    Identify slip, trip, and fall hazards and remove from the general work area. Remember to give adequate clearance so that the items being removed do not pose future hazards.
- iv)     Adequately protect yourself against the hazards by wearing boots that protect the ankles, long pants, and using insecticides.
- v)      Consider the limitations of manual or mechanical equipment for the clearance of overgrowth, particularly the safety hazards when using sling blades, machetes, weed eaters, bush hogs, or other brush removing equipment.

Before taking any action, determine whether there any ecological issues that would affect or prevent the removal of overgrowth in protected areas such as wetlands, wildlife habitats, or sanctuaries for endangered and/or protected species.

## 5.2.2 POISONOUS PLANTS

Common *Poison Ivy* grows as a small plant, a vine, and a shrub. Poison Ivy occurs in every state. The leaves always consist of three glossy leaflets. *Poison Sumac* grows as a woody shrub or small tree 5 to 25 feet tall. It usually contains nine leaves, with eight paired leaves and one on top, and is common in swampy areas. The plants are potent sensitizers and can cause mild to severe allergic reaction, referred to as "contact dermatitis." *These plants are found in the U.S. and Canada.*

Dermatitis, in Rhus-sensitive persons, may result from contact with the milky sap found in the roots, stems, leaves, and fruit, and may be carried by contacted animals, equipment, or apparel.

The best form of prevention is to avoid contact. Wearing long sleeves and gloves, and disposable clothing, such as Tyvek®, is recommended in high-risk areas to avoid exposure from contaminated apparel. Barrier creams and cleaners are also recommended.

## 5.2.3 INSECTS

### *Ticks*

Ticks are blood feeding external parasites of mammals, birds, and reptiles throughout the world. Some human diseases of current interest in the United States caused by tick-borne pathogens include Lyme disease, ehrlichiosis, babesiosis, Rocky Mountain spotted fever, tularemia, and tick-borne relapsing fever. Lyme disease is caused by a bacterial parasite called spirochete and is spread by infected ticks that live in and near wooded areas, tall grass, and brush. The ticks that cause the disease in the Northeast and Midwest are often no bigger than a poppy seed or a comma in a newsprint. The peak months for human infection are June through October. There are many other tick borne diseases such as Rocky Mountain spotted fever, which can be carried by a variety of ticks. The prevention and treatment of these diseases are similar to those of Lyme disease.

### *Prevention*

Preventative measures include wearing light-colored clothing, keeping clothing buttoned, tucking pant legs in socks, and keeping shirttails tucked in. Periodic checks for ticks should be made during the day, and especially at night. Hair should also be

checked by parting it and combing through it to make sure that no ticks have attached to the scalp. Also, check clothing when it is first removed, before ticks have a chance to crawl off.

The most common repellents recommended for ticks are N,N-dimethyl-m-toluamide, or DEET. It is important to follow the manufacturer's instructions found on the container for use with all insecticides especially those containing DEET.

In general, DEET insect repellent should only be applied to clothing, not directly on the skin. Do not apply to sunburns, cuts, or abrasions. Use soap and water to remove DEET once indoors.

### ***Removal***

The best way to remove a tick is removal by tweezers. If tweezers are not available, cover your fingers (tissue paper) while grasping the tick. It is important to grasp the tick as close as possible to the site of attachment and use a firm steady pull to remove it. When removing the tick, be certain to remove all the mouthparts from your skin so as not to cause irritation or infection. Wash hands immediately after with soap and water, and apply antiseptic to the area where tick was removed. Get medical attention if necessary.

### ***Symptoms of Lyme Disease***

The first symptoms of Lyme disease usually appear from 2 days to a few weeks after an infected tick bites a person. Symptoms usually consist of a ring-like red rash on the skin where the tick attached, and is often bulls eye like with red on the outside and clear in the center. The rash may be warm, itchy, tender, and/or "doughy" and appears in only 60 to 80 percent of infected persons. An infected person also has flu-like symptoms of fever, fatigue, chills, headaches, a stiff neck, and muscle aches and pains (especially knees). Rashes may be found some distance away from original rash. Symptoms often disappear after a few weeks.

### ***Bees, Wasps, and Yellow Jackets***

Insects that sting are members of the order Hymenoptera of the class Insecta. There are two major subgroups: aphids (honeybees, bumblebees) and vespids (wasps, yellow jackets, hornets). Aphids are docile and usually do not sting unless provoked. The stinger of the honeybee has multiple barbs, which usually detaches after a sting. Vespids have few barbs and can inflict multiple stings.

Types of stinging insects that might be encountered on this project Site may include:

- Carpenter Bees
- Yellow Jackets
- Honeybees
- Bumblebees
- Cicada Killer Wasps
- Paper Wasps
- Mud Dauber Wasps
- Giant Hornets

### ***Symptoms***

If you are stung there are three types of reactions you can have, a normal, a toxic, or an allergic reaction.

- Normal reaction - only lasts a few hours and consists of pain, redness, swelling, itching, and warmth near the sting area.
- Toxic reaction - will last for several days and results from multiple stings and may cause cramps, headaches, fever, and drowsiness.
- Allergic reaction - might cause hives, itching, swelling, tightness in the chest area and a possibility of breathing difficulties, dizziness, unconsciousness, and cardiac arrest.

The stingers of many *Hymenoptera* may remain in the skin and should be removed as quickly as possible without concern for the method of removal. An ice cube placed over the sting will reduce pain; aspirin may also be useful. Persons with known hypersensitivity to such stings should carry a kit containing epinephrine in a prefilled syringe. Antihistamines may help decrease hives and angioedema. Persons who have severe symptoms of anaphylaxis, have positive venom skin test results, and are at risk for subsequent stings should receive immunotherapy regardless of age or time since anaphylaxis.

### ***Precautions***

The following precautions can help you avoid stings. Try to wear light colored clothing and shy away from dark or floral prints. Avoid wearing perfumes, hairsprays, colognes, and scented deodorants while working outside. If eating outside, keep all food and drinks covered; sweet foods and strong scents attract stinging insects as well. Never swat or swing at the insect, it is best to wait for it to leave, softly blow it away, or gently brush it aside. Seek medical attention when the reaction to a sting includes swelling, itching, dizziness, or shortness of breath.

If physical control measures are not effective, use a pesticide that will have a minimal impact on both you and the environment.



### ***Fire Ants***

Fire ants are reddish-brown in color and range from 1/8 inch to 3/8 inch in length. When a fire ant stings an individual, the individual is rarely only stung once. Most fire ant stings result in a raised welt with a white pustule. If stung by a fire ant, continue to observe the welt and try to prevent secondary infection by keeping the welt intact. However, some individuals may have an allergic reaction to a fire ant sting and require immediate medical attention. Pesticides and even hot water can be used to kill fire ant colonies. *Fire ants are normally seen in the southern states.*

### ***Mosquitoes***

Mosquitoes are common pests that can be found in any state and any work environment where warm, humid conditions exist. Mosquitoes can pass along diseases such as West Nile virus and Malaria. Several different methods can be used to control adult mosquito populations: repellants such as DEET, mosquito traps, foggers, and vegetation and water management. *Mosquitoes are found from the tropics to the Arctic Circle and from lowlands to the peaks of high mountains.*

### ***Chiggers (trombiculidae)***

**Trombiculidae** is a family of mites called **trombiculid mites** (also called *berry bugs*, *harvest mites*, *red bugs*, *scrub-itch mites*, and, in their larval stage, *chiggers*). Trombiculidae live in the forests and grasslands and are also found in low, damp areas where vegetation is rank such as woodlands, berry bushes, orchards, along lakes and streams, and even in drier places where vegetation is low such as lawns, golf courses, and parks. They are most numerous in early summer when grass, weeds, and other vegetation are heaviest. These relatives of ticks are nearly microscopic measuring 0.4 mm (1/100 of an inch) and have a chrome-orange hue.

In their larval stage they attach to various animals, including humans, and feed on skin, often causing itching. The severe itching is accompanied by red pimple-like bumps (papules) or hives and skin rash or lesions on a sun-exposed area. For humans, itching usually occurs after the larvae detach from the skin.

In the United States, they are found mostly in the southeast, the south, and the Midwest. They are not present, or barely found, in far northern areas, in high mountains, and in deserts.

## Prevention

Chiggers are commonly found on the tip of blades of grasses to catch a host, so keeping grass short and removing brush and wood debris where potential mite hosts may live can limit their impact on an area. Sunlight that penetrates the grass will make the lawn drier and make it less favorable for chigger survival.

Chigger bites can be minimized by the use of tightly woven protective clothing, including long pants, which make it hard for them to reach warm, covered areas of the body. Application of insect repellent containing DEET to the shoes, lower trousers, and skin is also useful. Because they are found in grass, staying on trails, roads, or paths can prevent contact.

## Treatment

To reduce the itching, an application of anti-itch cream containing hydrocortisone or benzyl benzoate is often used. Hydrogen peroxide and capsaicin cream has also been effective, as has common household vinegar (5 percent acetic acid). Another good way to relieve itching is to apply heat - either by using a hand held shower with water hot as one can stand, or by heating the bite with a hair dryer. The heat method will relieve itching for about 4 hours and will require repeating. An Epsom salt bath may also help alleviate itching.

## Removal

The most effective way of removing chiggers is by washing the affected areas with warm water and soap. This must be done as soon as possible after exposure or possible exposure. Carefully wash the ankles, feet, behind the knees, and under the arms and chest. Wading for a few minutes in salt water will both get rid of the mites on one's skin and clothing and also alleviate the itching from their bites. Clothing, especially pants and socks, should be immediately discarded after returning from areas where exposure may have occurred. However, once symptoms appear, it may be too late to prevent further bites. Taking a hot bath when already covered with chigger bites may be uncomfortable and increase itching symptoms. Do not rub and scratch the skin aggressively, as this can break the skin and leave it vulnerable to a more serious infection.

#### 5.2.4 THREATENING DOGS

If you are approached by a frightened or menacing dog:

- i) Do not attempt to run and don't turn your back.
- ii) Stay quiet, and remember to breathe.
- iii) B still, with arms at sides or folded over chest with hands in fists.
- iv) Slowly walk away sideways.
- v) Do not stare a dog in the eyes, as this will be interpreted as a threat.
- vi) Avoid eye contact.
- vii) If you have a jacket, you could wrap it around your arm and should he snap, take the bite harmlessly.
- viii) Try calling its bluff. Yell, "sit!" "Stay!" or "go home!" You might convince the dog that you are the stronger in the situation.

#### 5.2.5 RODENTS

*Rodentia: (rats, mice, beavers, squirrels, guinea pigs, capybaras, coypu)*

Rodents, or Rodentia, are the most abundant order of mammals. There are hundreds of species of rats; the most common being the black and brown rat.

The **Brown Rat** has small ears, blunt nose, and short hair. It is approximately 14 to 18 inches long (with tail). They frequently infest garbage/rubbish, slaughterhouses, domestic dwellings, warehouses, shops, and supermarkets, in fact anywhere there is an easy meal and potential nesting sites.

The **Black Rat** can be identified by its tail, which is always longer than the combined length of the head and body. It is also slimmer and more agile than the Norwegian or Brown rat. Its size varies according to its environment and food supply.

The **House Mouse** has the amazing ability to adapt and it now occurs more or less in human dwellings. In buildings, mice will live anywhere and they are very difficult to keep out. Mice are also totally omnivorous; in other words, they will eat anything.

Rats and mice often become a serious problem in cold winter months when they seek food and warmth inside buildings. They may suddenly appear in large numbers when

excavation work disturbs their in-ground nesting locations or their food source is changed.

There are six major problems caused by rats and mice:

- i) They eat food and contaminate it with urine and excrement.
- ii) They gnaw into materials such as paper, books, wood, or upholstery, which they use as nest material. They also gnaw plastic, cinder blocks, soft metals such as lead and aluminum, and wiring, which may cause a fire hazard.
- iii) Rats occasionally bite people and may kill small animals.
- iv) They, or the parasites they carry (such as fleas, mites, and worms), spread many diseases such as salmonella, trichinosis, rat bite fever, hantavirus, Weil's disease, and the bubonic plague.
- v) Rats can damage ornamental plants by burrowing among the roots or feeding on new growth or twigs. They also eat some garden vegetables, such as corn and squash.
- vi) Rats and mice are socially unacceptable. These rodents have been a problem for centuries, chiefly because they have an incredible ability to survive and are so difficult to eliminate. In addition, they are extremely compatible with human behavior and needs.

## 5.2.6 SNAKES

Snakes may be found in any region of the country. While many snakes encountered are not venomous, a few are; so it is best that you give a wide berth to all snakes. Of the 7,000 venomous snakebites reported each year, only about 15 prove to be fatal, so your chances of survival are extremely high. The usual snake encounter is one in which they see you before you see them, and they slither away from you quickly, startling you. If you see a snake, back away from it slowly and do not touch it. If you or someone you know are bitten try to see and remember the color and shape of the snake, which can help with treatment of the snakebite.

Venomous snakes include the Coral Snake, Cobra, and Pit Vipers, such as the Cottonmouth (Water Moccasin), Copperhead, and Rattlesnake. The venom of pit vipers is primarily *hematotoxic* because it acts upon the victim's blood system. This venom breaks down blood cells and blood vessels and affects heart action. Bite victims experience severe burning pain, localized swelling and discoloration for the first 3 to 30 minutes, followed by nausea, vomiting, and occasional diarrhea and usually shock.

### *Preventing Snakebites*

Watching where you step, put your hands, or sit down is one of the best ways to prevent snakebites. Poisonous snakes live on or near the ground and often like rocks, woodpiles, and other spots that offer both a place to sun and a place to hide. Most bites occur in and around the ankle. About 99 percent of all bites occur below the knee, except when someone accidentally picks up or falls on the snake.

Watching where you step and wearing boots in tall grass can prevent most snakebites. Another means to protect against snakebites is snake chaps.

### *Emergency First Aid for Poisonous Snakebite*

Although it is important to obtain medical aid immediately, emergency first aid can slow the spread of poison from the bite. Remain calm and avoid unnecessary movement, especially if someone is with you. The rate of venom distribution throughout your body will be slower if you are still and quiet. *Do not* use home remedies, and *do not* drink alcoholic beverages.

In addition, learn the following procedures so you do not waste time before getting medical attention.

If less than 60 minutes is required to reach a hospital or other medical aid, follow this procedure:

- i) Apply a constricting band 2 to 4 inches on each side of the bite. The band should be loose enough to slip your finger under without difficulty, so that you do not cut off circulation completely. Properly applied, the constricting band can be left safely in place for 1 hour without adjustment.
- ii) If ice is available, place some in a towel, shirt, or other piece of cloth and apply it to the bite area. Do not bind it to the bite, but keep it loosely in place. Do not use the ice pack for more than *1 hour*. The objective is to cool the venom and slow its action, but not to freeze the tissue.
- iii) The primary function of the constricting band and ice pack is to slow the spread of venom through your body. Remove them slowly so there will not be a sudden rush of venom through your blood stream.

## **6.0      GENERAL SAFETY PRACTICES**

### **6.1            GENERAL SAFETY ISSUES**

- i)      At least one copy of this HASP must be at the project Site, in a location readily available to all personnel, and reviewed by all project personnel prior to starting work.
- ii)     All project personnel must use the buddy system (working in pairs or teams).
- iii)    Food, beverages, or tobacco products must not be present or consumed in the TEZ and CRZ. Cosmetics must not be applied within these zones.
- iv)    Emergency equipment such as eyewash, fire extinguishers, etc., must be removed from storage areas and staged in readily accessible locations.
- v)     Contaminated waste, debris, and clothing must be properly contained and legible and understandable precautionary labels must be affixed to the containers.
- vi)    Removing contaminated soil from protective clothing or equipment with compressed air, shaking, or any other means that disperses contaminants into the air is prohibited.
- vii)    Containers must be moved only with the proper equipment, and must be secured to prevent dropping or loss of control during transport.
- viii)   Visitors to the Site must abide by the following:
- ix)    All visitors must be instructed to stay outside the TEZ and CRZ and remain within the SZ during the extent of their stay. Visitors must be cautioned to avoid skin contact with surfaces which are contaminated or suspected to be contaminated. Visitors must be made aware of the Emergency Gathering Point, shown on Figure 6.1.

### **6.2            BUDDY SYSTEM**

All project personnel must use the buddy system. Visual contact must be maintained between crew members at all times, and crew members must observe each other for signs of chemical exposure, heat, or cold stress. Indications of adverse effects include, but are not limited to:

- i)      Changes in complexion and skin coloration.
- ii)     Changes in coordination.

- iii) Excessive salivation and pupillary response.
- iv) Changes in speech pattern.

Project personnel must also be aware of potential exposure to possible safety hazards, unsafe acts, or noncompliance with safety procedures. Individuals must inform their partners or fellow team members of non-visible effects of exposure to toxic materials. The symptoms of such exposure may include:

- i) Headaches.
- ii) Dizziness.
- iii) Nausea.
- iv) Blurred vision.
- v) Cramps
- vi) Irritation of eyes, skin, or respiratory tract.

If protective equipment or noise levels impair communications, prearranged hand signals must be used for communication. Personnel must stay within line of sight of another team member.

## **6.3 SANITATION**

Site sanitation will be maintained according to OSHA and Department of Health requirements.

### **6.3.1 BREAK AREA**

Breaks must be taken in the SZ, away from the active work area after Site personnel go through decontamination procedures. There will be no smoking, eating, drinking, or chewing gum or tobacco in the area other than the SZ.

### **6.3.2      POTABLE WATER**

The following rules apply for all project field operations:

- i)      An adequate supply of potable water will be provided at the Site. Potable water must be kept away from hazardous materials, contaminated clothing, and contaminated equipment.
- ii)     Portable containers used to dispense drinking water must be capable of being tightly closed, and must be equipped with a tap dispenser. Water must not be drunk directly from the container, nor dipped from the container.
- iii)    Containers used for drinking water must be clearly marked and not used for any other purpose.
- iv)     Disposable cups must be supplied, and both a sanitary container for unused cups and a receptacle for disposing of used cups must be provided.

### **6.3.3      SANITARY FACILITIES**

Access to facilities for washing before eating, drinking, or smoking will be provided.

### **6.3.4      TRASH COLLECTION**

Trash collected from the CRZ will be separated as potentially contaminated waste. Trash collected in the support and break areas will be disposed of as non-hazardous waste. Trash receptacles will be set up in the CRZ and in the SZ.



## **7.0 SITE CONTROL**

### **7.1 AUTHORIZATION TO ENTER**

All personnel working in EZs must have completed hazardous waste operations initial training as defined under OSHA Regulation 29 CFR 1926.65; have completed their training or refresher training within the past 12 months, and have been certified by a physician as fit for hazardous waste operations in order to enter a Site area designated as an EZ or CRZ. Personnel without such training or medical certification may enter the designated SZ only. The SHO will maintain a list of authorized persons; only personnel on the authorized list will be allowed within the EZ or CRZ.

### **7.2 SITE ORIENTATION AND HAZARD BRIEFING**

No person will be allowed in the general work area during project operations without first being given a Site orientation and hazard briefing. This orientation will be presented by the SHO, and will consist of a review of this HASP. This review must cover the chemical, physical, and biological hazards, protective equipment, safe work procedures, and emergency procedures for the project. A Training Acknowledgement Form is provided in Appendix D for documentation purposes. In addition to this meeting, Daily Safety Meetings will be held each day before work begins. All individuals on the Site, including visitors, must document their attendance to the initial briefing as well attending the Daily Safety Meetings. Appendix D also presents the forms that will be used for documenting the Daily Safety Meeting.

### **7.3 CERTIFICATION DOCUMENTS**

The PM, SS and SHO are responsible for ensuring that all personnel working at the Site meet the training and medical surveillance requirements. Subcontractor personnel must provide their training and medical documentation to the SHO prior to the start of fieldwork.

### **7.4 ENTRY REQUIREMENTS**

In addition to the authorization, hazard briefing and certification requirements listed above, no person will be allowed to enter the Site unless he or she is wearing the minimum support zone PPE as described in Section 4.0. Personnel entering the EZ or CRZ must wear the required PPE for those locations.

## **7.5        EMERGENCY ENTRY AND EXIT**

Individuals who must enter the Site on an emergency basis will be briefed of the hazards by the SHO. All hazardous activities will cease in the event of an emergency and any sources of emissions will be controlled, if possible.

People exiting the Site because of an emergency will gather in a safe area for a head count. The SHO is responsible for ensuring that all people who entered the work area have exited in the event of an emergency.

## **7.6        CONTAMINATION CONTROL ZONES**

Contamination control zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas.

### **7.6.1      TEMPORARY EXCLUSION ZONE (TEZ)**

The TEZ consists of the specific work area, or may be the entire area of suspected contamination. All personnel entering the TEZ must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work. The TEZ is the defined area where there is a possible respiratory and/or contact health hazard. Cones, caution tape, or other appropriate means will identify the location of each TEZ.

### **7.6.2      CONTAMINATION REDUCTION ZONE (CRZ)**

The CRZ or transition area will be established, if necessary, to perform decontamination of personnel and equipment. All personnel entering or leaving the TEZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated in a specific location. The decontamination of all personnel will be performed on-Site adjacent to the TEZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the TEZ and the SZ.

### 7.6.3 SUPPORT ZONE (SZ)

The SZ is a clean area outside the CRZ located to prevent personnel from exposure to hazardous substances. Eating and drinking will be permitted in the support area only after proper decontamination. Smoking may be permitted in the SZ, subject to Site requirements.

## **8.0 SITE DECONTAMINATION PROGRAM**

It is the responsibility of the SS and SHO to ensure that all personnel and pieces of equipment are properly decontaminated according to the procedures outlined below.

### **8.1 CONTAMINATION PREVENTION**

One of the most important aspects of decontamination is the prevention of the spread of contamination. Good contamination prevention will minimize personnel and public exposure. Proper decontamination procedures and the following procedures of contamination avoidance shall reduce the potential spread of contamination include:

- i) Do not walk through areas of obvious or known contamination.
- ii) Do not handle or touch contaminated materials directly.
- iii) Fasten all closures on suits, covering with tape if necessary.
- iv) Take particular care to protect any skin injuries.
- v) Stay upwind of airborne contaminants, when possible.

### **8.2 PERSONAL DECONTAMINATION**

All PPE will be disposed of and/or decontaminated at the conclusion of each workday as described below. Decontamination procedures will follow the concept of deconning the most contaminated PPE first.

All disposable equipment shall be removed before meal breaks and at the conclusion of the workday and replaced with new equipment prior to commencing work. In addition, respirator cartridges will be changed as breakthrough is obtained, as directed by the SS and SHO. Respiratory equipment and other non-disposables will be fully decontaminated and then placed in a clean storage area. Respirator decontamination will be conducted daily whenever respirators are being worn. Project personnel will inspect their respirator on a daily basis to ensure its proper operation.

### **8.2.1      LEVEL D DECONTAMINATION**

Level D decontamination procedures are as follows:

Step 1 - Remove all visible contamination and loose debris by washing with clean, water.

Step 2 - Remove all outer clothing that came in contact with the contamination (i.e., boot covers and outer gloves) and either dispose of in disposable container or wash in detergent solution and rinse.

Step 3 - Remove protective clothing; dispose of in disposable container.

Step 4 - Wash and rinse hands.

### **8.2.2      EQUIPMENT DECONTAMINATION**

All vehicles and pieces of equipment (e.g., drill rigs) that have entered any EZ will be decontaminated at the decontamination pad prior to leaving the Site. If the level of vehicle contamination is low, decontamination may be limited to rinsing of tires, wheel wells and tracks with water. If the vehicle or piece of equipment is significantly contaminated, steam cleaning or pressure washing of vehicles and equipment may be required.

A designated decontamination area will also be established inside the treatment building so that pieces of equipment may be cleaned (decontaminated as necessary).

The wash waters from all decontamination pads will be collected and processed through the treatment system.

## **9.0 SITE MONITORING**

### **9.1 AIR MONITORING**

Air monitoring will be conducted to evaluate airborne contaminant levels. The monitoring results will dictate work procedures and the selection of PPE. The monitoring device to be used, at a minimum, is a PID equipped with an 11.7 eV lamp.

Monitoring for organic vapors for the purpose of estimating worker exposure level will be conducted in the breathing zone with the PID during project activities. At a minimum, all readings will be recorded on an hourly basis on air monitoring logs or field notebooks. Section 4.2.1 presents the action levels for respiratory protection.

Air monitoring will be conducted continuously with the PID during drilling or other intrusive work. All work activity must stop where readings indicate the concentration of flammable vapors exceeds 2,000 ppm at a location with a potential ignition source. Such a reading would indicate that the concentration may approach 10 percent of the Lower Explosive Limit (LEL). This situation is highly unlikely; however, such an area must be ventilated to reduce the concentration to an acceptable level.

### **9.2 MONITORING EQUIPMENT MAINTENANCE AND CALIBRATION**

The PID should be calibrated under the approximate environmental conditions the instrument will be used. The instrument must be calibrated before and after use, noting the reading(s) and any adjustments which are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be documented on a calibration log or in the field notebook. All completed documentation/forms must be reviewed by the SHO.

The PID will be maintained and calibrated in accordance with the specific manufacturers' procedures. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturers' procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventive maintenance.

If an instrument is found to be inoperative or suspected of giving erroneous readings, the SHO must be responsible for immediately removing the instrument from service and obtaining a replacement unit. The SHO will be responsible for ensuring a replacement unit is obtained and/or repairs are initiated on the defective equipment.

## **10.0 PERSONNEL TRAINING**

### **10.1 GENERAL**

Required project personnel must have completed hazardous waste operations-related training, as required by the OSHA Standard 29 CFR 1926.65. Field personnel also receive a minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their training more than 12 months prior to the start of the project must have, if required, completed an 8-hour refresher course within the past 12 months. The SS must also have completed an additional 8 hours of training that is required by OSHA for supervisors.

### **10.2 BASIC 40-HOUR COURSE**

The following is a list of the topics typically covered in a 40 hour training course:

- i) General safety procedures.
- ii) Physical hazards (fall protection, noise, and heat stress, cold stress).
- iii) Names and job descriptions of key personnel responsible for Site health and safety.
- iv) Safety, health, and other hazards typically present at hazardous waste sites.
- v) Use, application, and limitations of PPE.
- vi) Work practices by which individuals can minimize risks from hazards.
- vii) Safe use of engineering controls and equipment on Site.
- viii) Medical surveillance requirements.
- ix) Recognition of symptoms and signs, which might indicate overexposure to hazards.
- x) Worker right-to-know (Hazard Communication OSHA 1926.59/1910.1200).
- xi) Routes of exposure to contaminants.
- xii) Engineering controls and safe work practices.
- xiii) Components of a Site HASP.
- xiv) decontamination practices for personnel and equipment.
- xv) confined space entry procedures.
- xvi) general emergency response procedures.

### **10.3      SUPERVISOR COURSE**

Management and supervisors receive an additional 8 hours of training which typically includes:

- i)      General Site safety and health procedures.
- ii)     Emergency procedures.
- iii)    PPE programs.
- iv)    Air monitoring techniques.

### **10.4      SITE-SPECIFIC TRAINING**

Site-specific training will be accomplished through a Site briefing on the contents of this HASP before work begins. This training will be presented by the Project Manager, SS, or SHO. The training will include a discussion of the chemical, physical, and biological hazards, the protective equipment and safety procedures, and emergency procedures. The Training Acknowledgement Form that shall be used is found in Appendix D.

### **10.5      DAILY SAFETY MEETINGS**

Daily Safety Meetings will be held to cover safety concerns for the work that will be conducted each day. The meeting will cover emergency response procedures and the hazards anticipated during the project work on this day, the protective clothing required and any required procedure that will minimize hazards. These meetings will be presented by the SS or SHO prior to beginning the day's fieldwork. No work will be performed in an EZ before the daily safety meeting has been held. The daily safety meeting must also be held prior to new tasks, and repeated if new hazards are encountered. The forms that shall be used for documenting the daily safety meetings are also found in Appendix D.

### **10.6      FIRST AID AND CPR**

At least one individual current in First Aid/CPR will be assigned to the work crew and will be on the Site during operations. Refresher training in First Aid (triennially) and CPR (annually) are required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens.



## **11.0 MEDICAL SURVEILLANCE PROGRAM**

### **11.1 MEDICAL EXAMINATION**

All required personnel who will enter a Site EZ or CRZ must have successfully completed a pre-placement and/or annual physical examination prior to entering one of these work zones. This medical surveillance program must comply with OSHA 29 CFR 1926.65(f).

#### **11.1.1 PRE-PLACEMENT MEDICAL EXAMINATION**

All on-Site project personnel who will enter an EZ or CRZ must have completed a comprehensive medical examination within the past 12 months that meets the requirements of applicable OSHA Regulations. The annual medical examination typically includes the following elements:

- i) Medical and occupational history questionnaire.
- ii) Physical examination.
- iii) Complete blood count, with differential.
- iv) Liver enzyme profile.
- v) Chest X-ray, once every 3 years, for non-asbestos workers.
- vi) Pulmonary function test.
- vii) Audiogram.
- viii) Electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination.
- ix) Drug and alcohol screening, as required by job assignment.
- x) Visual acuity.
- xi) Follow-up examinations, at the discretion of the examining physician or the corporate medical director.

The examining physician provides the individual and employer with a report summarizing the findings confirming the worker's fitness for work and ability to wear a respirator. Documentation of medical clearance will be available for project personnel during all project work.

Subcontractors will certify that all of their personnel have successfully completed a physical examination by a qualified physician. The physical examination must meet the

requirements of 29 CFR 1926.65 and 29 CFR 1910.134 as described above. Subcontractors will supply copies of the medical examination certificate for each of their on-Site workers.

#### **11.1.2      OTHER MEDICAL EXAMINATION**

In addition to pre-employment, annual, and exit physicals, personnel may be examined:

- i)      At any individual's request after known or suspected exposure to toxic or hazardous materials.
- ii)     At the discretion of the client, SHO, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials.
- iii)    At the discretion of the occupational physician.

#### **11.1.3      PERIODIC EXAM**

Following the placement examination, all personnel must undergo a periodic examination, similar in scope to the placement examination. For individuals potentially exposed over 30 days per year, the frequency of periodic examinations will be annual. For personnel potentially exposed less than 30 days per year, the frequency for periodic examinations may be 24 months or as determined by the physician.

#### **11.2        MEDICAL RESTRICTION**

When the examining physician identifies a need to restrict work activity, the individual's supervisor must communicate the restriction to the individual, the individual's supervisor, and the SHO. The terms of the restriction will be discussed with the individual and his/her supervisor. Every attempt should be made to keep the individual working, while not violating the terms of the medical restriction.

## 12.0 EMERGENCY PROCEDURES

### 12.1 GENERAL

The work area will be evaluated for the potential for fire, explosion, chemical release, or other catastrophic events. Unusual events, activities, chemicals, and conditions will be reported to the SS and SHO immediately.

The SS and SHO will establish evacuation routes and assembly areas for each work area. All personnel entering the Site will be informed of these routes and assembly areas. If necessary, a Site plan will be made marking the evacuation routes and will be posted at conspicuous locations.

### 12.2 EMERGENCY RESPONSE

If an incident occurs, the following steps will be taken:

- i) The SS will evaluate the incident and assess the need for assistance and/or evacuation.
- ii) The SS or SHO will call for outside assistance as needed and report the incident **within 1 hour** through the CRA Incident Reporting Hotline. The number is 1-866-529-4886.
- iii) The SS will act as liaison between outside agencies and on-Site personnel.
- iv) The SS will ensure the Project Manager and the RSHM are notified promptly of the incident.
- v) The SS will take appropriate measures to stabilize the incident scene.

#### 12.2.1 FIRE

In the case of a fire on the Site, the SS will assess the situation and direct fire fighting activities. The SS will ensure that the client Site representative (as appropriate) is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that Site personnel are unable to safely extinguish, the local fire department will be summoned via 911 or other number.

### **12.2.2      SPILL**

If a spill occurs, the following steps will be taken:

- i)      Notify SS and or SHO immediately.
- ii)     Evacuate immediate area of spill.
- iii)    Conduct air monitoring to determine needed level of PPE.
- iv)    Don required level of PPE and prepare to make entry to apply spill containment and control procedures.
- v)     Absorb or otherwise clean up the spill and containerize the material, sorbent, and affected soils. If the spill has occurred inside the treatment facility wash down the spill into the floor sump.

The SS has the authority to commit resources as needed to contain and control released material and to prevent its spread to off-Site areas.

### **12.3          MEDICAL EMERGENCY**

All personnel injuries must be promptly reported to the SS and SHO. The SS and SHO will:

- i)      Ensure that the injured person receives prompt first aid and medical attention.
- ii)     In emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room).
- iii)    The Project Manager and RSHM are to be notified by project personnel as soon as possible after the worker has left the Site.

#### **12.3.1      FIRST AID - GENERAL**

All persons must report any near loss incident, accident, injury, or illness to their immediate Supervisor, SHO and the SS. Trained personnel will provide First Aid. Injuries and illnesses requiring medical treatment must be documented. The PM with the help of the SS must conduct an accident investigation as soon as emergency conditions no longer exist and first aid and/or medical treatment has been ensured. These two reports must be completed and submitted to the PM and RSHM within 24 hours after the incident.

If first aid treatment is required, first aid kits are kept at the CRZ. If treatment beyond first aid is required, the injured should be transported to the medical facility. If the injured is not ambulatory, or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance/paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker. Otherwise, perform the following:

- i) Survey the Scene: Determine if it is safe to proceed. Try to determine if the conditions which caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim.
- ii) Do a Primary Survey of the Victim: Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.
- iii) Phone Emergency Medical Services (EMS): Give the location, telephone number used, caller's name, what happened, number of victims, victims' condition, and help being given.
- iv) Maintain Airway and Perform Rescue Breathing: As necessary.
- v) Perform CPR: As necessary.
- vi) Do a Secondary Survey of the Victim: Check vital signs and do a head-to-toe exam.
- vii) Treat Other Conditions: As necessary. If the victim can be moved, take him to a location away from the work area where EMS can gain access.

### **12.3.2      FIRST AID - INHALATION**

Any individual complaining of symptoms of chemical overexposure as described in Section 5.1.5 will be removed from the work area and transported to the designated medical facility for examination and treatment.

### **12.3.3      FIRST AID - INGESTION**

Call 911 and consult a poison control center for advice. If known and available, refer to the MSDS for treatment information, if recommended. If unconscious, keep the victim on his side and clear the airway if vomiting occurs.

#### **12.3.4      FIRST AID - SKIN CONTACT**

Project personnel who have had skin contact with contaminants will, unless the contact is severe, proceed through the decontamination zone, to the wash-up area. Personnel will remove any contaminated clothing, and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he/she shows any sign of skin reddening, irritation, or if he requests a medical examination.

#### **12.3.5      FIRST AID - EYE CONTACT**

Project personnel who have had contaminants splashed in their eyes or who have experienced eye irritation while in the contaminated zone, must immediately proceed to the eyewash station, set up in the decontamination zone. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

#### **12.4          REPORTING INJURIES AND ILLNESSES**

All injuries and illnesses, however minor, will be reported to the CRA Incident Reporting Hotline (1-866-529-4886), the SS and SHO immediately. The SS will complete an Incident Report and submit it to the Project Manager and RSHM within 24 hours.

#### **12.5          EMERGENCY INFORMATION**

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the Daily Safety Meeting. Agencies include:

Police Department (Niagara County Sheriff Dept.).....	911
Fire Department (Niagara County Fire Dispatch).....	911
Hospital (Borgess Pipp Hospital).....	269-685-0700
Plainwell Police (Plainwell) .....	269-685-9858
Poison Control Center.....	800-222-1222
MDEQ (Jackson).....	517-780-7690
CRA Project Manager (Greg Carli).....	716-297-6150
CRA Regional Safety and Health Manager (Craig Gebhardt).....	716-297-2160
USEPA (Hotline).....	800-424-9346

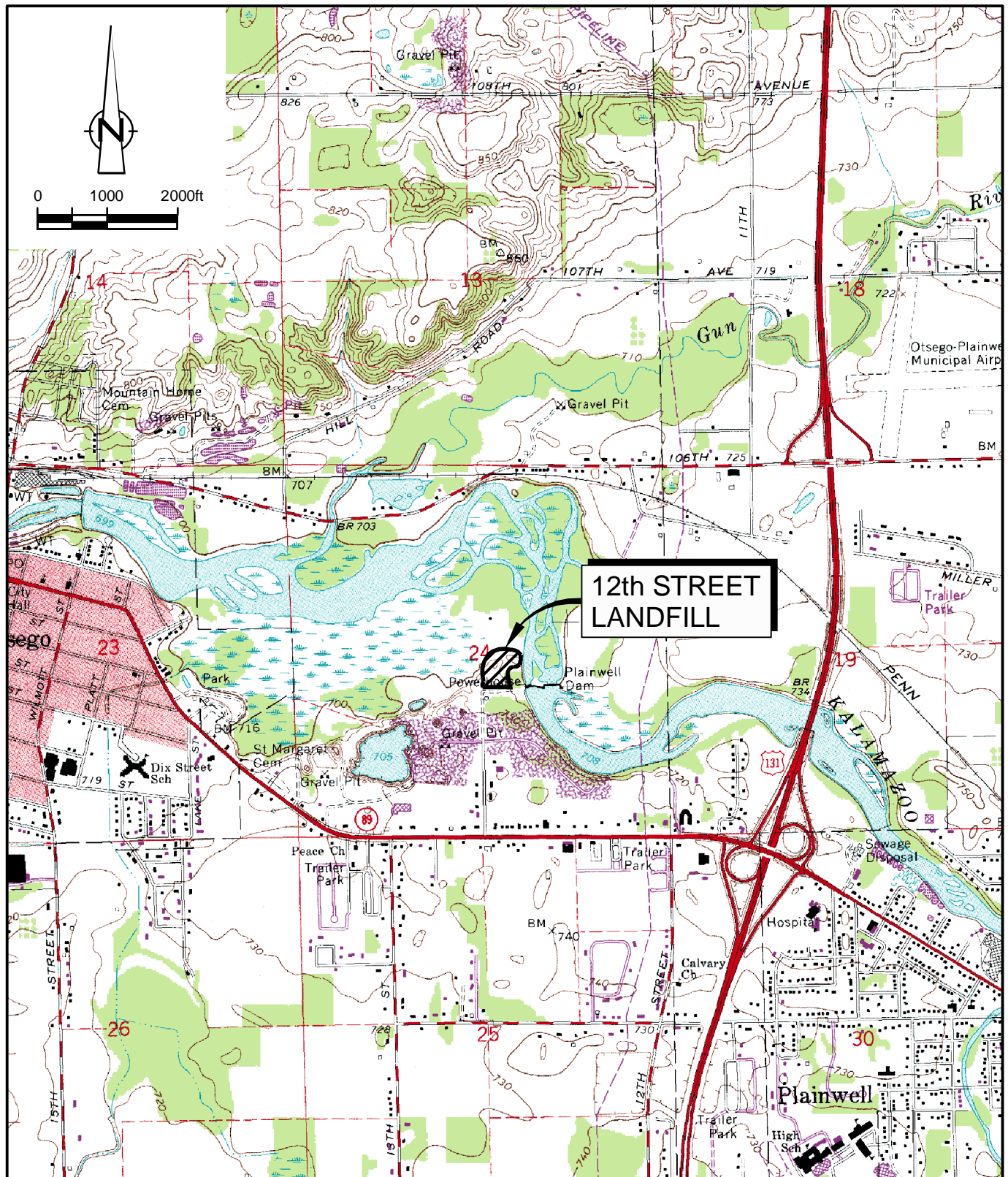
National Response Center.....	800-424-8802
NYSDEC (Albany).....	800-457-7362
CRA Incident Reporting Hotline.....	866-529-4886

Hospital (Borgess Pipp Hospital – Plainwell, Michigan)

Figure 12.1 presents the Emergency Route to the Hospital.

## FIGURES





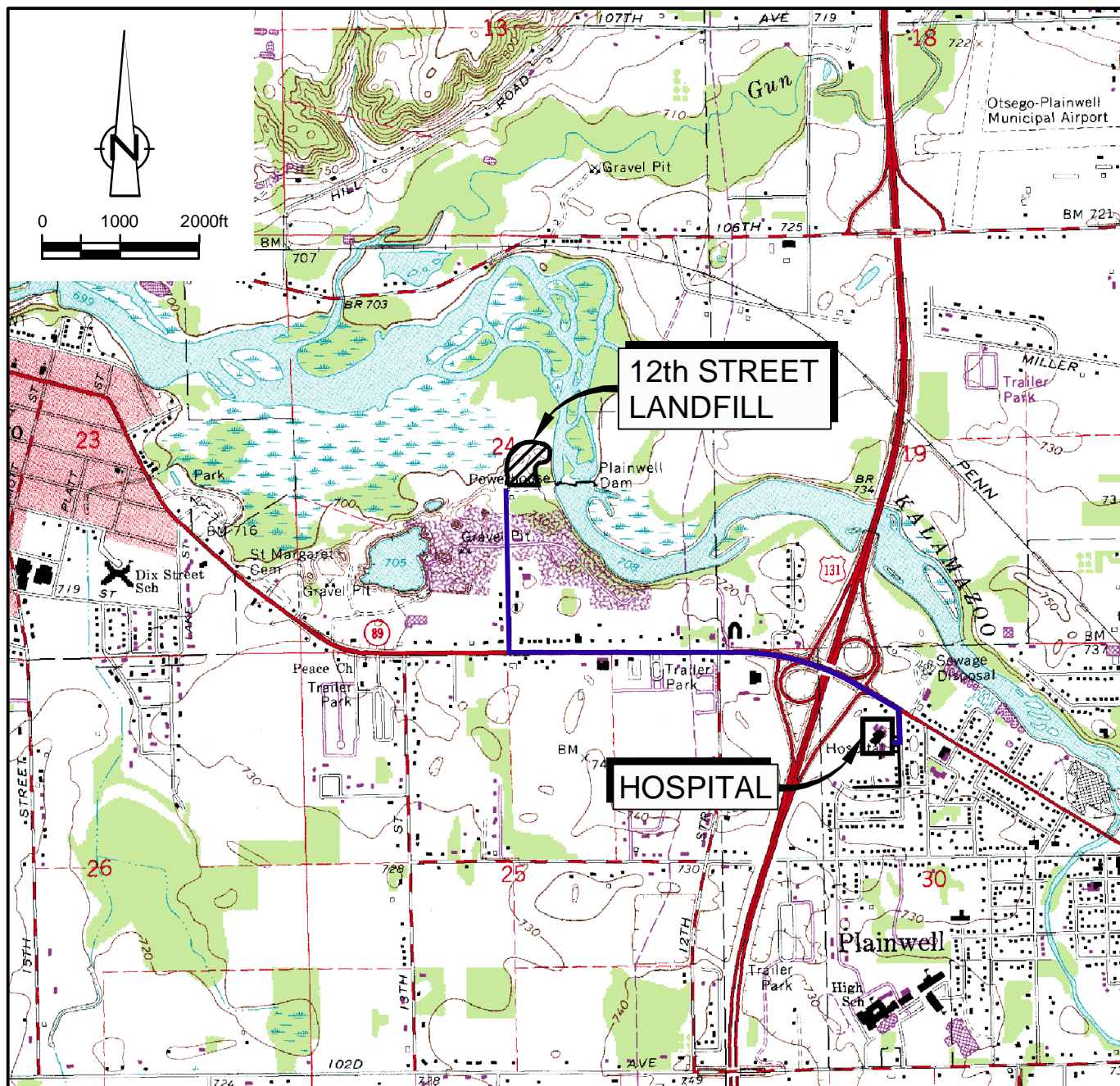
SOURCE: USGS QUADRANGLE MAP;  
OTSEGO, MICHIGAN  
PHOTO REVISED 1973



figure 1.1  
SITE LOCATION MAP  
12th STREET LANDFILL SITE  
*Otsego Township, Michigan*







SOURCE: USGS QUADRANGLE MAP;  
OTSEGO, MICHIGAN  
PHOTO REVISED 1973

#### DIRECTIONS TO BORGESS PIPP HOSPITAL

1. TRAVEL SOUTH ON 12th STREET TO ALLEGAN STREET.
2. MAKE A LEFT ONTO ALLEGAN STREET. TAKE ALLEGAN STREET TO NAOMI STREET.
3. MAKE A LEFT ONTO NAOMI STREET. FOLLOW NAOMI STREET TO THE HOSPITAL.

#### LEGEND

- APPROXIMATE SITE BOUNDARY
- HOSPITAL ROUTE



OTSEGO ■

BORGESS PIPP HOSPITAL  
411 NAOMI STREET  
EMERGENCY DEPARTMENT  
PLAINWELL, MI 49080  
(269) 685-0700  
BORGESS.COM



figure 12.1  
**HOSPITAL ROUTE MAP**  
**12th STREET LANDFILL SITE**  
*Otsego Township, Michigan*

## TABLES



TABLE 2.1

**PROPERTIES AND DETECTED CONCENTRATIONS OF CHEMICAL COMPOUNDS OF CONCERN IN SITE SOILS, WASTE AND GROUNDWATER  
12th STREET LANDFILL**

<i><b>Chemical Name (Synonyms)</b></i>	<i><b>Concentration at Site</b></i>	<i><b>Exposure Limits</b></i>	<i><b>Routes Of Entry</b></i>	<i><b>Symptoms/Health Effects</b></i>	<i><b>Chemical Properties</b></i>	<i><b>Physical Characteristics</b></i>
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.0000918 mg/kg	There are no numerical limits set although in view of its adverse effects, all contact should be avoided.	Skin absorption Inhalation	ACUTE: <b>Inhalation</b> - Can cause burning sensation in nose and throat, headache, dizziness, nausea, vomiting, pain in the joints, tiredness, emotional disorders, blurred vision and muscle pain, nervousness, irritability and intolerance to cold. Itching, swelling and redness followed by acne-like eruptions of the skin known as chloracne commonly occur. Symptoms may appear weeks or months after initial exposure and may last a few months up to 15 years. Can cause abnormalities of liver, pancreas, circulatory system and respiratory system and death. <b>Skin</b> - Contact with very small amounts can cause chloracne. <b>Eyes</b> - Can cause burning and irritation. <b>Ingestion</b> - Can cause effects described under inhalation. Animal studies suggest that daily exposure to amounts smaller than one grain of salt may cause severe symptoms and death within a few weeks. CHRONIC: Long term exposure can cause reduced ability to inhale, chloracne, and numbness and tingling in arms and legs. A blood abnormality may occur which may include light sensitive skin, blisters, dark skin coloration, excessive hair growth and dark red urine. Reproduc	(FP) NI (VP) 0.000002 mm (IP) NI (UEL) NI (LEL) NI	Colorless to white, crystalline solid. Dioxin has no use as such; it is an inadvertent contaminant in herbicide precursors and thus in the herbicides themselves. It is applied in herbicide formulations.
MEK 2-Butanone Methyl ethyl ketone Methyl acetone CAS-78-93-3	Detection noted in groundwater on-Site. Value not presented in reporting.	TLV: 200 ppm PEL: 200 ppm STEL: 300 ppm IDLH: 3,000 ppm	Inhalation Ingestion Skin contact Eye contact	ACUTE: Vapors are irritating to eyes, skin, nose and causes headaches. Ingestion causes dizziness and vomiting. May affect CNS. CHRONIC: Defatting of the skin.	(FP) 16°F (VP) 78 mm (IP) 9.54 eV (UEL) 11.4% (LEL) 1.4%	Colorless liquid with a moderately sharp, fragrant mint- or acetone-like odor.
4,4-DDD	35.0 mg/kg	NI - Use exposure limits for DDT	Skin contact Inhalation Ingestion Eye contact	Similar to DDT	NI	Technical grade DDT may also contain DDE and DDD as contaminants. DDD was also used to kill pests, but to a far lesser extent than DDT.
4,4-DDE	32.0 mg/kg	NI - Use exposure limits for DDT	Skin contact Inhalation Ingestion Eye contact	Similar to DDT	NI	Both DDE and DDD are breakdown products of DDT.

TABLE 2.1

**PROPERTIES AND DETECTED CONCENTRATIONS OF CHEMICAL COMPOUNDS OF CONCERN IN SITE SOILS, WASTE AND GROUNDWATER  
12th STREET LANDFILL**

<b>Chemical Name (Synonyms)</b>	<b>Concentration at Site</b>	<b>Exposure Limits</b>	<b>Routes Of Entry</b>	<b>Symptoms/Health Effects</b>	<b>Chemical Properties</b>	<b>Physical Characteristics</b>
Acetone 2-Propanone Methyl ketone Dimethyl ketone CAS-67-64-1	Detection noted in groundwater on-Site. Value not presented in reporting.	TLV: 500 ppm PEL: 1,000 ppm STEL: 750 ppm IDLH: 2,500 ppm	Inhalation Ingestion Skin Contact Eye Contact	ACUTE: Vapors irritating to eyes and respiratory tract. May cause headaches and dizziness, effects on CNS, liver, kidneys and gastrointestinal tract. CHRONIC: Prolonged contact causes defatting of the skin, possibly dermatitis. Substance may affect blood and bone marrow.	(FP) 0 degrees F (VP) 180 mm (IP) 9.69 eV (UEL) 12.8 % (LEL) 2.5%	Colorless liquid. With characteristic mint-like odor.
Aldrin	4.4 mg/kg	TLV: 0.05 mg/m3 [skin] PEL: 0.25 mg/m3 STEL (NIOSH): ND IDLH: 25 mg/m3	Inhalation Absorption Ingestion Contact Hazard	ACUTE: Points of attack are the central nervous system, liver, kidneys, and skin. Harmful effects and symptoms are headache, nausea, vomiting, dizziness, and mild clonic jerking. Aldrin can produce convulsions without warning. Aldrin can burn the skin and eyes. Poisoning by aldrin usually involves convulsions due to its effects on the central nervous system. CHRONIC: Reproductive effects and liver effects have also been reported. It is classified as an extremely toxic chemical.	(FP) NA (VP) 0.00008 mm (IP) ND (UEL) NA (LEL) NA	Aldrin is similar chemically and toxicologically to dieldrin. Colorless to dark brown crystalline solid with a mild chemical odor.
Polychlorinated Biphenyls PCB (42%) Chlorodiphenyl (42% chlorine) Aroclor 1242 CAS-53469-21-9	120 mg/kg (soils) 0.0014 mg/L (leachate)	TLV: 1 mg/m3 [skin] PEL: 1 mg/m3 [skin] STEL: NE IDLH: 5 mg/m3	Inhalation Absorption (skin) Ingestion	ACUTE: Eye irritation. CHRONIC: Dermatitis, chloracne, liver damage.	(FP) NA (VP) 0.001 mm (IP) NE (UEL) NA (LEL) NA	Colorless to light colored viscous liquid with a mild hydrocarbon odor.
Arsenic CAS-7440-38-2	41.5 mg/kg	TLV: 0.01 mg/m3 [skin] PEL: 0.010 mg/m3 STEL: NE IDLH: 5 mg/m3 (as As)	Inhalation Absorption Ingestion	ACUTE: Contact dermatitis, gastrointestinal disturbances, and respiratory irritation. CHRONIC: Hyperpigmentation of the skin and cancers of the skin, lungs, and lymphatic system.	(FP) NA (VP) 0 mm (approx.) (IP) NA (UEL) NA (LEL) NA	Silver-gray or tin-white, brittle, odorless, solid.
Benzene Benzol CAS-71-43-2	1 ppm	TLV: 0.5 ppm [skin] PEL: 1 ppm STEL: 5 ppm IDLH: 500 ppm	Inhalation Absorption (skin) Ingestion	ACUTE: Irritation to eyes, skin, respiratory tract; dizziness; headache; nausea; staggered gait; fatigue, abdominal pain. CHRONIC: Defatting of the skin, may have effects on bone marrow and immune system, decrease in blood cells. Carcinogenic to humans.	(FP) 12°F (VP) 75 mm (IP) 9.24 eV (UEL) 7.8% (LEL) 1.2%	Colorless to light-yellow liquid with an aromatic odor. Solid below 42°F.

TABLE 2.1

**PROPERTIES AND DETECTED CONCENTRATIONS OF CHEMICAL COMPOUNDS OF CONCERN IN SITE SOILS, WASTE AND GROUNDWATER  
12th STREET LANDFILL**

<b>Chemical Name (Synonyms)</b>	<b>Concentration at Site</b>	<b>Exposure Limits</b>	<b>Routes Of Entry</b>	<b>Symptoms/Health Effects</b>	<b>Chemical Properties</b>	<b>Physical Characteristics</b>
Chlordane Chlordan Chlordano CAS-57-74-9	39.0 mg/kg	TLV: 0.5 mg/m3 [skin] PEL: 0.5 mg/m3 STEL: NE IDLH: 100 mg/m3	Inhalation Skin absorption Ingestion, Skin contact Eye contact	ACUTE: Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, CHRONIC: Convulsions; anuria; in animals: lung, liver, kidney damage; [potential occupational carcinogen]	(FP) NE (VP) NE (IP) NE (UEL) NE (LEL) NE	Noncombustible Liquid, but may be utilized in flammable solutions.
4,4-DDT	75.0 mg/kg	TLV: 1 mg/m3 [skin] PEL: 1 mg/m3 STEL: NE IDLH: 500 mg/m3 (ca)	Inhalation Ingestion Skin contact Absorption Eye contact	ACUTE: Inhalation - Nausea, drowsiness, loss of appetite, visual disturbances, and insomnia. Skin - See ingestion. Ingestion - Headaches, nausea, insomnia, profuse sweating, frothing at the mouth, convulsions, and lack of consciousness. CHRONIC: Dizziness, nausea, muscle twitch, convulsions, enlarged liver, and skin irritation. Suspected carcinogen.	(FP) 162-171°F (VP) 0.00000002 mm (IP) NI (UEL) NI (LEL) NI	White to yellow crystalline powder with a slight musty odor, (pesticide).
Dieldrin HEOD CAS-60-57-1	17.0 mg/kg	TLV: 0.25 mg/m3 PEL: 0.25 mg/m3 [skin] STEL: NE IDLH: 50 mg/m3	Inhalation Skin absorption Ingestion Skin contact Eye contact	ACUTE: Headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions. CHRONIC: coma; [potential occupational carcinogen]; in animals: liver, kidney damage.	(FP) NE (VP) 77°F (IP) NE (UEL) NE (LEL) NE	Colorless to light-tan crystals with a mild, chemical odor. [insecticide].
Heptachlor CAS-76-44-8	16.0 mg/kg	TLV: 0.05 mg/m3 [skin] PEL: 0.05 mg/m3 [skin] STEL: NE IDLH: 35 mg/m3	Inhalation Ingestion Absorption (skin)	ACUTE: May effect CNS, convulsions. CHRONIC: Liver damage may occur. Possible human carcinogen.	(FP) NOT Combustible (VP) 0.0003 mm @ 77°F (IP) NA (UEL) NA (LEL) NA	White crystals or tan waxy solid with a camphor-like odor (insecticide).
Lead (metal) CAS-7439-92-1	575 mg/kg	TLV: 0.05 mg/m3 PEL: 0.05 mg/m3 STEL: NE IDLH: 100 mg/m3	Inhalation Ingestion Skin contact Eye contact	ACUTE: Lead is a cumulative poison, however, it may cause eye and skin irritation. CHRONIC: Effects blood, bone marrow, CNS, PNS and kidneys resulting in anemia, convulsions, peripheral nerve disease and kidney impairment. Toxicity to human reproduction or development.	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	A heavy, ductile, soft, gray solid. Turns tarnished on exposure to air.



TABLE 2.1

**PROPERTIES AND DETECTED CONCENTRATIONS OF CHEMICAL COMPOUNDS OF CONCERN IN SITE SOILS, WASTE AND GROUNDWATER  
12th STREET LANDFILL**

<b>Chemical Name (Synonyms)</b>	<b>Concentration at Site</b>	<b>Exposure Limits</b>	<b>Routes Of Entry</b>	<b>Symptoms/Health Effects</b>	<b>Chemical Properties</b>	<b>Physical Characteristics</b>
Methane Methyl hydride CAS-74-82-8	landfill gas varies up to 24.7% methane in GW up to 0.2 % by volume	TLV: NA - Simple Asphyxiant PEL: NA STEL: NA IDLH: NA	Inhalation	ACUTE: NA CHRONIC: Asphyxiation	(FP) -306°F (VP) NA (IP) 12.48 eV (UEL) 15.0% (LEL) 5.0%	Colorless, compressed or liquified gas, with no odor. Gas is LIGHTER than air.
Polychlorinated Biphenyls PCB (54%) Chlorodiphenyl (54% chlorine) Aroclor 1254 CAS-11097-69-1	158.0 mg/kg	TLV: 0.5 mg/m3 [skin] PEL: 0.5 mg/m3 [skin] STEL: NA IDLH: 5 mg/m3	Inhalation Absorption (skin) Ingestion	ACUTE: Eye irritation. CHRONIC: Dermatitis, chloracne, liver damage.	(FP) NA (VP) 0.00006 mm (IP) NA (UEL) NA (LEL) NA	Colorless to pale yellow viscous liquid or solid (<50°F) with a mild hydrocarbon odor.
Toluene Methylbenzene Toluol CAS-108-88-3	29 mg/kg	TLV: 20 ppm PEL: 200 ppm STEL: 150 ppm (C) IDLH: 500 ppm	Inhalation Ingestion Absorption	ACUTE: Irritation to eyes and respiratory tract. Ingestion may cause chemical pneumonitis. Affects CNS. Unconsciousness and cardiac dysrhythmia at high level exposures. CHRONIC: Defatting of the skin. Affects CNS. Enhanced hearing damage.	(FP) 40°F (VP) 21 mm (IP) 8.82 eV (UEL) 7.1% (LEL) 1.1%	Colorless liquid with a sweet, pungent, benzene-like odor.
Xylene (o;m;p isomers) CAS-106-42-3	unknown	TLV: 100 ppm PEL: 100 ppm STEL: 150 ppm IDLH: 900 ppm	Inhalation Absorption Ingestion	ACUTE: Irritation to eyes and respiratory tract. Ingestion may cause chemical pneumonitis. Affects CNS. CHRONIC: Defatting of the skin, lung damage resulting in chronic bronchitis. Affects CNS and blood.	(FP) 90/82/81°F (IP) 7/9/9 mm (IP) 8.56/8.56/8.44eV (UEL) 7.0% (LEL) 0.9%	Colorless liquid with an aromatic odor. (p- isomer solid <56°F).

## APPENDIX A

### **FORMS**

HASP PLAN ACKNOWLEDGEMENT SHEET

DAILY SAFETY MEETING LOGS

LOCKOUT TAG OUT FORMS

INCIDENT REPORTING FORMS

NEAR LOSS REPORTING FORMS

CRA SAFETY COORDINATION REVIEW FORM

STEP OBSERVATION FORMS

CONFINED SPACE ENTRY FORMS

SAFETY INSPECTION CHECKLIST FOR EXCAVATIONS

## HASP ACKNOWLEDGMENT SHEET

This is to certify that I have received a pre-entry briefing regarding this HASP (CRA - 12<sup>th</sup> Street Landfill Site and Former Plainwell Paper Mill Site) and I understand its contents. My failure to follow and comply with the requirements contained in this plan may result in disciplinary action and/or termination.

## Print Name

**Signature**

Date

[illegible]

**DAILY SAFETY MEETING LOG  
CONESTOGA-ROVERS & ASSOCIATES**

PROJECT: 12<sup>th</sup> Street Landfill -OU-4

LOCATION: 12<sup>th</sup> Street, Otsego, Michigan

DATE/TIME: \_\_\_\_\_

1. Safety Issues or Topics Discussed:	
<b>DAILY SITE SAFETY INSPECTION/AUDIT CONDUCTED - REPORT UNSAFE ACTS, CONDITIONS, and/or PRACTICES IMMEDIATELY AND IMPLEMENT CORRECTIVE ACTIONS.</b>	
2. Work Summary and Physical/Chemical Hazards of Concern:	
<b>Planned Activities:</b>	
<b>List JSAs reviewed:</b>	
<b>Physical hazards:</b>	
<b>Biological hazards:</b>	
<b>Chemicals onsite:</b>	
3. Protective Equipment/Procedures: Refer to task JSA and HASP for additional information	
4. Emergency Procedure:	
<b>MUSTERING POINT =</b>	
<b>In event of an emergency gather/proceed to mustering point(s). Review Contingency Plan</b>	
<b>Emergency Procedures for Area(s) of activity.</b>	
<b>Print Name</b>	<b>Signature</b>
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

**DAILY SAFETY MEETING LOG  
CONESTOGA-ROVERS & ASSOCIATES**

PROJECT: Former Plainwell Paper Mill

LOCATION: 220 Allegan Street, Plainwell, Michigan

DATE/TIME: \_\_\_\_\_

1. Safety Issues or Topics Discussed:	
<b>DAILY SITE SAFETY INSPECTION/AUDIT CONDUCTED - REPORT UNSAFE ACTS, CONDITIONS, and/or PRACTICES IMMEDIATELY AND IMPLEMENT CORRECTIVE ACTIONS.</b>	
2. Work Summary and Physical/Chemical Hazards of Concern:	
<b>Planned Activities:</b>	
<b>List JSAs reviewed:</b>	
<b>Physical hazards:</b>	
<b>Biological hazards:</b>	
<b>Chemicals onsite:</b>	
3. Protective Equipment/Procedures: Refer to task JSA and HASP for additional information	
4. Emergency Procedure:	
<b>MUSTERING POINT =</b>	
<b>In event of an emergency gather/proceed to mustering point(s). Review Contingency Plan</b>	
<b>Emergency Procedures for Area(s) of activity.</b>	
<b>Print Name</b>	<b>Signature</b>
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	



CONESTOGA-ROVERS & ASSOCIATES  
Hazardous Energy Control Program  
(Lockout/Tagout)



Safety Means Awareness  
Responsibility Teamwork

APPENDIX A

Project Name:	Project Number:
Name of Facility:	Maintenance or Repair Activity:
Equipment Name:	Equipment Serial Number:
<u>Energy Sources Present:</u>	
<input type="checkbox"/> Electrical <input type="checkbox"/> Chemical <input type="checkbox"/> Mechanical <input type="checkbox"/> Pneumatic <input type="checkbox"/> Hydraulic <input type="checkbox"/> Thermal	
<input type="checkbox"/> Other: _____	

SHUT DOWN					
	Energy Source	Isolating Device	Location	Action	Verification Step
1					
2					

Note: Photos may be attached to facilitate LOTO procedure detailed above.

START UP					
	Energy Source	Isolating Device	Location	Action	Verification Step
2					
1					

Note: Photos may be attached to facilitate LOTO procedure detailed above.

**Lockout/Tagout Procedure Written By:**

Name: \_\_\_\_\_ SS#: \_\_\_\_\_ Date: \_\_\_\_\_ Signature: \_\_\_\_\_

**Procedure Verification**

The procedure listed above was field tested/verified by \_\_\_\_\_ of \_\_\_\_\_ on the \_\_\_\_ day of \_\_\_\_\_, 200\_\_.

If the energy sources affecting this equipment are modified in anyway, the overall procedure should be reevaluated.



**CONESTOGA-ROVERS & ASSOCIATES**  
**Hazardous Energy Control Program**  
**(Lockout/Tagout)**



Safety Means Awareness  
Responsibility Teamwork

**APPENDIX B**

LOCKOUT/TAGOUT PERIODIC INSPECTION	
Project Name:	Project Number:
Name of Facility:	Maintenance or Repair Activity:
Equipment Name:	Equipment Serial Number:
<u>Energy Sources Present:</u>	
<input type="checkbox"/> Electrical <input type="checkbox"/> Chemical <input type="checkbox"/> Mechanical <input type="checkbox"/> Pneumatic <input type="checkbox"/> Hydraulic <input type="checkbox"/> Thermal	
<input type="checkbox"/> Other: _____	

Are changes to the procedure required?    ☐ YES    ☐ NO

If YES, identify: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Employees included in the inspection: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Supervisor (Print Name)

\_\_\_\_\_  
Signature

Date of Inspection: \_\_\_\_\_

# CONESTOGA-ROVERS & ASSOCIATES (CRA) INCIDENT REPORTING FORM

**Incidents must be called into Incident Hot Line: 1-866-529-4886**

Instructions: For Personal Injuries, Occupational Illnesses, and Property Damage, complete Sections 1 and 2.  
For Vehicle Accidents, Complete Sections 1, 2, and 4. Initial report must be submitted within 24 hours.

## SECTION 1

<b>Report Status - Insert Date:</b> ( / / ) <b>Initial Report</b> ( / / ) <b>Update Report</b> ( / / ) <b>Final Report</b> ( / / ) <b>Verification/Validation</b>											
<b>A. Employee Identification</b> ( ) CRA Employee ( ) Temporary Employee ( ) Subcontractor											
Employee No.		Last Name			First Name			Middle Name/Initial		M or F	
Area Code ( )		Telephone Number		Address (Street, City, State, Province, Zip Code)							
Date of Hire / /		Position/Title			Supervisor			Employee's Company/Office Location			
<b>B. General Information</b>											
Where did the incident occur? ( ) Office ( ) Project Site ( ) Other _____ ( ) Canada ( ) United States					Type of Loss (Check all that apply) ( ) Employee Injury/Illness ( ) Vehicle Accident ( ) Property Damage Only						
Address of Incident (City, State, Province, Zip Code)					Specific Location of Incident (e.g., where on site)						
Date and Hour of Loss			Date and Hour Reported to Employer			Date and Hour Last Worked			Time Employee Began Work		
Month	Day	Year	a.m.	p.m.	Month	Day	Year	a.m.	p.m.	a.m.	p.m.
Normal Work Hours on Last Day Worked			Witnesses?		Witness Name and Telephone Number						
From: a.m.			( ) Yes ( ) No								
To: p.m.											
<b>C. Project Information (Project Related Loss Only) Project Related:</b> ( ) Yes ( ) No											
Project #		Project Name		Project Manager		Site Telephone Number ( )		Project Manager Cell Number ( )			
Was the Client Advised of the Loss? ( ) Yes ( ) No				Name			Date & Time				

## SECTION 2

<b>A. Details of the Loss</b>	
1. What job/task was being performed when the incident occurred? (Example: collecting groundwater samples).	
2. Provide a detailed description of the employee's specific activities at the time of the accident. Include details of equipment/materials being used, including the size and weights of objects being handled. If necessary, attach additional pages to the report.	
3. For injuries, identify the specific part of body injured, and specify left or right side. For illnesses, identify and describe the affected area/body part.	
4. Identify the object or substance that directly injured employee and how. Include size and weight of object, quantity of substance, etc.	
5. Identify property damaged and how it was damaged (include owner of property, nature and source of damage, model and serial number, if appropriate).	
<b>B. Health Care/Medical Treatment</b>	
Employee received health care? ( ) Yes ( ) No	Identify the type of health care provided and where it was performed. (Check all that apply). ( ) First Aid ( ) Medical treatment other than first aid (sutures, etc.) ( ) Hospitalized ( ) Clinic ( ) Hospital emergency room ( ) On location by self or CRA employee ( ) On site by EMT
Name of Health Care Provider, Physician's Name, Address (Street, City, State, Province/State, and Postal/Zip Code)	
<b>C. Loss Investigation ( ) 5 Why Root Cause Analysis Investigation [Non-OSHA Recordable, &lt;\$1,000 damage] ( ) Tap Root Root Cause Analysis [OSHA Recordable, and/or &gt;\$1,000 damages]</b>	
HASP prepared? ( ) Yes ( ) No ( ) Not applicable Submit a PDF of HASP and relevant JSA(s) to Investigation Team. If yes, what the HASP on-site? ( ) Yes ( ) No	Did the safety plan identify and provide safety procedures for the specific tasks the employee was conducting when injured? ( ) Yes ( ) No If no, why not? (Explain) _____ Did the employee utilize the STAR process before initiating the task? ( ) Yes ( ) No If no, why not? (Explain) _____ Was the employee post incident drug & alcohol tested ( ) Yes ( ) No

XXXXX (X)



**SECTION 2 (Continued)**

5 Why Root Cause:		
1. Why did "above" happen?	Verification	
2. Why did "1" happen?		
3. Why did "2" happen?		
4. Why did "3" happen?		
5. Why did "4" happen?		
6. Why did "5" happen?		
Additional information: Attach photos, witness statement(s), affected employee statement, diagrams, as applicable, to the end of this document.		
See the Causative Factors & Corrective Actions		
<b>D. Accountability</b>		
Initial Report Date Month      Day      Year	Initial Report Prepared by: (please print)	Initial Report Prepared by: (signature)
Investigation Team	Company	Position/Title
Final Report Date Month      Day      Year	Final Report Prepared by: (please print)	Final Report Prepared by: (signature)
<b>E. Stewardship</b>		
Will an Incident Summary be Prepared ( ) Yes      ( ) No By:	Disciplinary Action Taken? ( ) Yes ( ) No	
Quality Review By:	Date:	Findings:

*Fax Completed Form to CRA's Incident Reporting Fax: (832) 485-5259  
Send Original to CRA's Incident Reporting Department, Houston, Texas*

**SECTION 3**

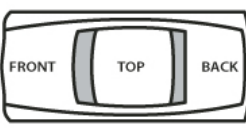
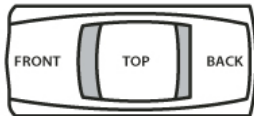
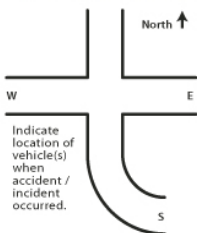
<b>D. Agency Reporting and Recording Information (To be completed by the Regional Safety and Health Manager)</b>			
<b>CANADA</b>			
Form 7 Sent to WSIB? ( ) Yes      ( ) Not required	Employee Injury Information (Injury met the following criteria) ( ) First Aid      ( ) Medical Treatment      ( ) Critical Injury      ( ) Modified Duty      ( ) Lost Time Injury  If medical treatment, what?		
Joint Safety and Health Committee Notified? ( ) Yes      ( ) No	Total days of modified duty  If exceeds 7 days, report to WSIB.	Total days of lost time (if any)	Date employee returned to work Month      Day      Year
<b>UNITED STATES</b>			
OSHA Recordable Injury? ( ) Yes      ( ) No	Employee Injury Information (Injury met the following OSHA 300 Log criteria) ( ) First Aid      ( ) Medical Treatment      ( ) Restricted Duty      ( ) Lost Time Injury  If medical treatment, what?		
Total days of restricted duty	Total days of lost time (if any)		Date employee returned to work Month      Day      Year

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XXXXX (X)

**VEHICLE ACCIDENT SECTION**  
(Complete this Section for all Vehicle Accidents)

**SECTION 4**

<b>A. CRA Vehicle</b>					
License Plate No.		State/Province		Police Department	City State/Province
Vehicle Year/Make/Model		Odometer Reading at Time of Accident		Police Report Number	Weather Conditions
Name of Person Operating Vehicle			<div style="text-align: center;"> <b>"X" IN AREA OF VEHICLE DAMAGE</b>    <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="text-align: center;"> <b>CIRCLE</b>  0 No Damage  1 Light  2 Moderate  3 Heavy  4 Rolled  5 Burned </div> </div> </div>		
Address					
City	State/Province	Zip Code			
Telephone: Area Code (    )					
Vehicle Type: (    ) Personal (    ) Rental (    ) CRA-Own					
Description of Vehicle Damage:					
<b>B. Other Vehicles Involved</b>					
Name of Owner		Address		City/State/Prov./Zip	Area Code and Telephone Number (    )
Operator's Name (if different from above)		Address		City/State/Prov./Zip	Area Code and Telephone Number (    )
Year/Make/Model	Description of Property Damage:			<div style="text-align: center;"> <b>"x" IN AREA OF VEHICLE DAMAGE</b>    <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="text-align: center;"> <b>CIRCLE</b>  0 No Damage  1 Light  2 Moderate  3 Heavy  4 Rolled  5 Burned </div> </div> </div>	
Insurance Co. Name & Telephone					
License Plate No./State/Province					
<b>C. Injured Persons</b>					
Name	Address Street, City, State/Prov./Zip Code		Phone Number	Nature of Injury	Indicate if Injured was a Vehicle Driver/ Passenger, CRA Employee, Other, or Pedestrian
1.					
2.					
3.					
<b>D. Witnesses</b>					
Name		Address Street, City, State/Prov./Zip Code			Area Code and Telephone Number
1.					(    )
2.					(    )
<b>E. Description of Accident</b>					
<div style="border: 1px solid black; padding: 5px;"> <small>PLEASE COMPLETE OR ATTACH SEPARATE DIAGRAM</small>    </div>					
Was Ticket Issued: Other Operator <input type="checkbox"/> CRA Operator <input type="checkbox"/>		Reason: _____ _____ _____			
Report Date Month    Day    Year		Report Prepared by: (please print)		Report Prepared by: (signature)	

Note: If Additional Space is Required to Complete this Report, Use Separate Sheet of Paper and Attach.

**Fax Completed Form to CRA's Incident Reporting Fax: (832) 485-5259**  
**Send Original to CRA's Incident Reporting Department, Houston, Texas**

XXXXX (X)



## Incident Report Corrective Action Verification and Validation



Safety Means Awareness  
Responsibility Teamwork

Causative Factor(s) and Corrective Actions(s)						Verification (Did we do what we said we would do?) and Validation (Is it working?)		
Item No.	CF	Corrective Actions (Must match Causative Factor)	Responsible Party	Due Date	Date Completed	Verified By/ Validated By	Date	Details

### CRA 10 CAUSATIVE FACTORS (CF)

Personal Factors		Company Factors		External Factors	
1	Insufficient training for task	5	Incomplete or no procedures	10	Exposure to conditions
2	Hurrying to complete the task	6	Procedures not known or enforced		
3	Easier if proper process not followed	7	Improper PPE		
4	Took shortcuts without prior incident	8	Improper tools		
		9	Improper workplace layout		

XXXXX (X)



# CONESTOGA-ROVERS & ASSOCIATES (CRA) NEAR LOSS REPORTING FORM

A Significant Near Loss must be called into Incident Hot Line: 1-866-529-4886



Instructions: Complete the Near Loss Report and submit to your Supervisor

## SECTION 1

Report Status – Insert Date: ( / / ) Initial Report ( / / ) Update Report ( / / ) Final Report ( / / ) Verification/Validation							
A. Employee Identification ( ) CRA Employee ( ) Temporary Employee ( ) Subcontractor							
Employee No.		Last Name		First Name			
Date of Hire / /		Position/Title		Supervisor		Employee's Company/Office Location	
B. General Information							
Where did the Near Loss occur? ( ) Office ( ) Project Site ( ) Other _____ ( ) Canada ( ) United States				Type of Near Loss (Check all that apply) ( ) Employee Injury/Illness ( ) Vehicle Accident ( ) Property Damage ( ) Environmental			
Address of Near Loss (City, State, Providence, Zip Code)				Specific Location of Near Loss (eg where on site)			
Date and Hour of Near Loss		Date and Hour Reported to CRA		Hours on Last Day Worked		Time Employee Began Work	
Month	Day	a.m.	Month	Day	a.m.	From:	a.m.
Year		p.m.	Year		p.m.	To:	p.m.
							a.m. p.m.
Witnesses? Yes ( ) No ( )			Witness Name and Telephone Number				
C. Project Information (Project Related Near Loss Only): Project Related: ( ) Yes ( ) No							
Project #		Project Name		CRA Project Manager		Client	
						Client Contact	
Was the Client Advised of the Near Loss? ( ) Yes ( ) No ( ) N/A				Name:		Date & Time	

## SECTION 2

A. Details of the Near Loss	
1. What job/task was being performed when the Near Loss occurred? (Example: collecting groundwater samples).	
2. Provide a detailed description of the employee's specific activities at the time of the Near Loss. Include details of equipment/materials being used, including the size and weights of objects being handled. If necessary, attach additional pages to the report.	

B. Near Loss Investigation	
Conduct a 5-Why Root Cause Analysis Investigation. In addition, if there was the potential for a significant injury or loss report the Near Loss to Accident Hot Line so a Detailed Tap Root Cause Analysis	
HASP prepared? ( ) Yes ( ) No ( ) Not applicable Submit a PDF of HASP to Investigation Team. If yes, what the HASP on-site? ( ) Yes ( ) No	Did the safety plan identify and provide safety procedures for the specific tasks being performed when the Near Loss occurred? ( ) Yes ( ) No If no, why not? (Explain) _____ Did the employee utilize the STAR process before initiating the task? ( ) Yes ( ) No If no, why not? (Explain) _____

xxxxx (x))

5-Why Root Cause:		
1. Why did "above" happen?		Verification
2. Why did "1" happen?		
3. Why did "2" happen?		
4. Why did "3" happen?		
5. Why did "4" happen?		
6. Why did "5" happen?		
Additional information: Attach photos, witness statement(s), affected employee statement, accident diagrams, as applicable, to the end of this document.		
See the Causative Factors & Corrective Actions		
<b>C. Accountability</b>		
Initial Report Date Month          Day          Year	Initial Report Prepared by: (please print)	Initial Report Prepared by: (signature)
Investigation Team	Company	Position/Title
Final Report Date Month          Day          Year	Final Report Prepared by: (please print)	Final Report Prepared by: (signature)
<b>D. Stewardship</b>		
Will a Near Loss Summary be Prepared (   ) Yes          (   ) No By:		
Quality Review By:	Date:	Findings:

### SECTION 3

Corrective Action					Validation & Verification		
CF	Corrective Actions (Must match Causative Factor)	Responsible Party	Due Date	Date Completed	Verified By/ Validated By	Date	Details

### CRA 10 CAUSATIVE FACTORS (CF)

Personal Factors		Company Factors		External Factors	
1	Insufficient training for task	5	Incomplete or no procedures	10	Exposure to conditions
2	Hurrying to complete the task	6	Procedures not known or enforced		
3	Easier if proper process not followed	7	Improper PPE		
4	Took shortcuts without prior incident	8	Improper tools		
		9	Improper workplace layout		

## CRA SAFETY COORDINATION REVIEW

SECTION A - JOB SCOPE	
Pre-Job Meeting/Prep HASP	Completed by: _____
On-Site Orientation Meeting	_____
End of Job Evaluation	_____
Tailgate Safety Meeting Planning Tool	_____
Site Audit	_____
<p>Date: _____ Project Name: _____ Project Number: _____</p> <p>Project Location: _____</p> <p>Project Description: _____</p> <p><b>CRA Project Team</b></p> <p>PM: _____ Site Supervisor: _____ SHO: _____</p> <p>Technician(s): _____ Others: _____</p> <p><b>CLIENT INFORMATION</b></p> <p>Company Name: _____</p> <p>Address: _____</p> <p>Primary Contact: _____</p> <p>Phone: _____ Cell: _____ Fax: _____</p> <p><b>SUBCONTRACTOR INFORMATION</b></p> <p>Company Name: _____</p> <p>Address: _____</p> <p>Primary Contact: _____</p> <p>Phone: _____ Cell: _____ Fax: _____</p> <p style="text-align: center;"><b>additional subcontractors listed on last page</b></p>	

SECTION B - PROJECT SAFETY COORDINATION			
<b>1.1</b>	<b>High Risk Activities</b>	<b>Resource</b>	<b>Yes No</b>
	Confirm activities to be conducted during project		
	Working at or above 6 feet ( fall protection)	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Aerial lift	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Heavy equipment	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Drilling	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Excavation	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Lock-Out Tag-Out permit(s) required	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Hot work	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Hot work permit(s) required	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Confined space entry	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Confined space entry permit required	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Subsurface activities	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	ATV, Snowmobile, 4 wheeler	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Access agreements in-hand and signed by property owner	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>
	Permit requirements communicated to affected employees	PM	<table border="1" style="display: inline-table; width: 40px; height: 20px;"></table>

## CRA SAFETY COORDINATION REVIEW

<b>1.2</b>	<b>Guiding Principals</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	
	Safety Commitment	SMART	<input type="checkbox"/>	<input type="checkbox"/>	
	Injury Free Operation (IFO)	SMART	<input type="checkbox"/>	<input type="checkbox"/>	
	Stop Work Authority	SMART	<input type="checkbox"/>	<input type="checkbox"/>	
	Lessons Learned	SMART	<input type="checkbox"/>	<input type="checkbox"/>	
	Any unresolved safety concerns or issues	SS	<input type="checkbox"/>	<input type="checkbox"/>	
<b>1.3</b>	<b>Personnel Requirements</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
	Site personnel trained to execute the Scope of Work	PM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Verification of all personnel's training certifications	PM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Potential for language barrier issues for this project	PM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Potential technical understanding barriers for this project	PM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Number of SSE(s) on site concurrent with CRA/client policy	PM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Short Service Employee(s) identification	PM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Mentor assignment for each SSE(s)	PM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Employees trained to use the tools/equipment	PM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Verification of all personnel's:		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	- Medical clearance & respirator fit test (as required)	Safety Admin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	- Alcohol & drug clearance	Safety Admin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Daily personnel evaluation if they are fit to function and working safely	SS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Safety Health Officer required for the site	PM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>1.4</b>	<b>Behavior Based Safety - SMART Tools</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
	STAR/Loss Prevention Self Assessment (LPSAs)	SMART	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Near loss/incident reporting procedure	SMART	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	STEP/LPO	SMART	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	At-risk behaviors and observation trends	SMART	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>1.5</b>	<b>HASP Development &amp; Review</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
	Site-specific Health & Safety Plan developed	HASP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Site-specific Health & Safety Plan approval by CRA safety professional	HASP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	System to modify the Health & Safety Plan in the field (ie., "dirty JSA/JLA")	HASP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>1.6</b>	<b>JSA/JLA</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
	On-site hazard assessment	PM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	JSA/JLAs available for all tasks including those performed by subcontractors	HASP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Requirement to have JSA/JLAs modified in the field daily (ie., "dirty JSA/JLA")	SS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MSDSs obtained, reviewed, and hazards incorporated into JSA/JLAs	HASP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## CRA SAFETY COORDINATION REVIEW

<b>1.7</b>	<b>PPE</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
	Confirm task-specific PPE per JSA/JLAs	HASP			
	System to inspect PPE before start of work	SS			
<b>1.8</b>	<b>Site Emergency Response</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
	First-aid requirements	HASP			
	Minimum - one first-aid trained person on-site	HASP			
	First-aid equipment within 50 feet of risk	HASP			
	Eye wash/shower within 50 feet of risk	HASP			
	Spill response equipment inspected and available within 50 feet of risk	HASP			
	Emergency Action Plan (EAP) - specific personnel identified for key incident				
	command roles - discussed role responsibilities and actions with all site personnel, mustering/meeting location set	HASP			
	Site emergency evacuation alarm confirmed	SS			
	EAP drill schedule	HASP			
	Nearest hospital confirmation	HASP			
	Nearest hardwired telephone confirmation	Site Drawing			
	Emergency shut-off switch/valve locations confirmation	Site Drawing			
	Emergency contact confirmation - coordinate with facility and client	HASP			
<b>1.9</b>	<b>Utility Locates</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
	CRA and/or client-specific Subsurface Utility Clearance Protocol reviewed and adhered to	PM			
	QSF-019 Property Access Form completed	PM			
	Client-specific requirements communicated to all affected employees	PM			
	One-call responses verified	PM			
<b>1.10</b>	<b>Traffic Control Program</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
	Temporary Traffic Control Plan (TTCP) required	PM			
	TTCP provided	PM			
	TTCP approval by the client, if required	PM			
<b>1.11</b>	<b>Site Control</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
	Have the following areas been considered for site control:				
	Fencing, barricades or other identifiers	SS			
	Signage to control pedestrian traffic	SS			
	Safety perimeter around equipment and work zone	SS			
	Swing radius barricades and/or signage struck-by (crush zones) reviewed and controlled.	SS			
<b>1.12</b>	<b>Equipment</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
	Proper lifting/transport of heavy objects (drums, augers)	SS			
	Equipment inspected and documented where required	SS			
	GFCI used and tested	SS			



## CRA SAFETY COORDINATION REVIEW

<b>1.13 Weather</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
Weather condition changes discussed - how to handle during work	HASP			
Weather monitoring- who is responsible	HASP			
Weather related hazards (heat/cold accommodations)	HASP			
Hold time after lightning and thunder	SS			
<b>1.14 Crew Commitment</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
Crew is aware of Safety Commitment that they are making	TBD			
<b>1.15 Materials</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
MSDSs availability for all HAZCOM/WHMIS regulated materials on the job site	HASP			
Affected employees aware of special handling instructions for hazardous materials	HASP			
Hazardous materials stored appropriately	HASP			
Plan for dealing with leftover and/or waste materials	WP			
<b>1.16 Sub-Contractors</b> <i>(All items identified, verified and discussed)</i>	<b>Resource</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
Approval through the QSF 12, 22, 30, 31	PM			
CRA Safety Coordination Review Form completed with the subcontractor as applicable	PM			
<b>1.17 Documentation</b>		<b>Yes</b>	<b>No</b>	<b>N/A</b>
All required QS Forms are available and attached to the project file	PM			
- QSF-12	PM			
- QSF-13	PM			
- QSF-16	PM			
- QSF-19	PM			
- QSF-22	PM			
- QSF-30/31	PM			
- Meeting attendance sign in sheets	PM			
Daily Tailgate sign in sheets	PM			
Permits/air monitoring records	PM			
STEP observation form	PM			
Equipment inspection forms	PM			
Client specific forms	PM			

## SECTION C - ACTION ITEMS

[illegible]

HASP	Health and Safety Plan
PM	Project Manager
SS	Site Supervisor
SHO	Safety & Health Officer

## SUBCONTRACTOR INFORMATION

Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Primary Contact: \_\_\_\_\_  
Phone: \_\_\_\_\_ Cell: \_\_\_\_\_ FAX: \_\_\_\_\_

## SUBCONTRACTOR INFORMATION

Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Primary Contact: \_\_\_\_\_  
Phone: \_\_\_\_\_ Cell: \_\_\_\_\_ FAX: \_\_\_\_\_

Copies of the forms for Pre-Job Meeting and On-Site Orientation shall be maintained in the Project File



## SAFE TASK EVALUATION PROCESS (STEP)



Report Status:

(insert date)

Initial Report

Updated Report

Final Report

Verification/Validation

Date:	Time:	Project No. (if applicable):
Client:	Project Name:	
Office:	Work Group:	Site Location:
Subcontractor: <input type="checkbox"/> Yes <input type="checkbox"/> No	Subcontractor Company Name:	

Feedback Conducted By:	Date:	Time:
Observer's Name:	Observee's Supervisor:	

Check Task Being Observed (if not listed here, go to columns at right)		If checking this column, write in the specific task	
<input type="checkbox"/> Air Knifing	<input type="checkbox"/> Manual Lifting	<input type="checkbox"/> Agricultural Services	
<input type="checkbox"/> Clearing	<input type="checkbox"/> Mob/Demob	<input type="checkbox"/> Construction	
<input type="checkbox"/> Demolition	<input type="checkbox"/> Project Oversight	<input type="checkbox"/> Landfill	
<input type="checkbox"/> Drilling	<input type="checkbox"/> Soil Sampling	<input type="checkbox"/> Office Operations	
<input type="checkbox"/> Driving	<input type="checkbox"/> Stack Testing	<input type="checkbox"/> O&M	
<input type="checkbox"/> Electrical Work	<input type="checkbox"/> Surveys & Audits	<input type="checkbox"/> Pipeline	
<input type="checkbox"/> Excavation	<input type="checkbox"/> Traffic Control	<input type="checkbox"/> Refinery	
<input type="checkbox"/> General Site Cleaning	<input type="checkbox"/> UST Removal	<input type="checkbox"/> Treatment Plants	
<input type="checkbox"/> Heavy Equipment Operations	<input type="checkbox"/> Water Sampling	<input type="checkbox"/> Other	
<input type="checkbox"/> IH Sampling	<input type="checkbox"/> Well Management		

### Background Information (Give a brief description of task being performed and your surroundings)

--

### Observer's Positive Comments

--

### Feedback Conclusion (Why the Questionable Items Occurred)

--



PERSONAL PROTECTIVE EQUIPMENT	Meets Work Standards	???	N/A	Evaluation Comments
1. Hearing Protection (e.g., Ear Plugs)				
2. Head Protection (e.g., Hard Hat)				
3. Eye Protection (e.g., Safety Glasses/Goggles)				
4. Hand Protection (e.g., Gloves)				
5. Foot Protection (e.g., Steel-toe Boots)				
6. Respiratory Protection				
7. Fall Protection (e.g., lanyard/harness)				
8. High Visibility Clothing (e.g., Work Vest)				
9. First Aid Kit/Fire Extinguisher				
10. Other (be specific)				
BODY POSITION	Meets Work Standards	???	N/A	Evaluation Comments
11. Proper Body Positioning When Exerting Force (Lifting/Pushing/Pulling)				
12. Pinch Points/Moving Equipment - Hands/Body Placement				
13. 3-Points of Contact				
14. Other (be specific)				
WORK ENVIRONMENT	Meets Work Standards	???	N/A	Evaluation Comments
15. Work/Walk Surface Clear (Free And Clear Pathway)				
16. Housekeeping/Equipment Storage				
17. Controlled Work Zone (e.g., Warning Devices, Barricades, Cones, Flags)				
18. Emergency Stop/Safety Switches				
19. Materials Labeled Correctly				
20. Storage/Disposal of Waste				
21. Other (be specific)				
OPERATING PROCEDURES	Meets Work Standards	???	N/A	Evaluation Comments
22. STAR Performed/Job Planning				
23. Stop Work Authority				
24. JSA/JLA Reviewed and Followed				
25. Daily Site Inspection				
26. High Risk Task Specific (Hot Work, Confined Space, LOTO, Excavation/ Trenching)				
27. Inspect Work Zone for Hazards				
28. Coordinate/Communicate with Site Rep and/or other others on site				
29. Spotters used appropriately				
30. Underground/Overhead Utilities Identified				
31. Other (be specific)				
TOOLS/EQUIPMENT	Meets Work Standards	???	N/A	Evaluation Comments
32. Hand/Power Tool - Selection, Condition, and Use				
33. Field/Test Equipment - Selection, Condition, and Use				
34. Heavy Equipment - Selection, Condition, and Use				
35. Other (be specific)				
Observation Total Occurrences				
% Observations to Meet Work Standards				
Item Specific to Work Task	Meets Work Standards	???		Evaluation Comments
Insert Task/JSA/SOP Step				
Insert Task/JSA/SOP Step				
Insert Task/JSA/SOP Step				

[illegible]

## CRA 10 CAUSATIVE FACTORS

Personal Factors		Company Factors		External Factors	
1	Insufficient training for task	5	Incomplete or no procedures	10	Exposure to conditions
2	Hurrying to complete the task	6	Procedures not known or enforced		
3	Easier if proper process not followed	7	Improper PPE		
4	Took shortcuts without prior incident	8	Improper tools		
		9	Improper workplace layout		

# CRA

## CONFINED SPACE ENTRY PERMIT

Permit Date:                    /                    /                    CRA Office:                    \_\_\_\_\_  
Site Name:                    \_\_\_\_\_  
Job Number:                    \_\_\_\_\_ Entry Class (MN only)    ☐ IA    ☐ IB    ☐ II    ☐ III

### Section 1: Confined Space Characteristics

Purpose of Entry:                    (specify) \_\_\_\_\_

Locations and Configuration  
of Confined Space                    (specify) \_\_\_\_\_

### Section 2: Chemical and Physical Hazards

Materials Present or Previously Stored in space (specify):\* \_\_\_\_\_

Material State:                    ☐ Solid                    ☐ Liquid                    ☐ Gas                    ☐ Sludge

Physical Hazards:                    ☐ Physical Exertion                    ☐ Heat Stress                    ☐ Cold Stress                    ☐ Heavy Equipment  
☐ Fire Hazards                    ☐ Lifting Hazards                    ☐ Slip, Trip, Fall                    ☐ High Noise  
☐ Overhead Hazard                    ☐ Underground Hazard                    ☐ Fall Protection                    ☐ Electrical  
☐ Hand/Power Tools                    ☐ Welding/Cutting                    ☐ Sparks                    ☐ Grinding  
☐ Explosive                    ☐ Visibility                    ☐ Respiratory (dust)                    ☐ Splash  
☐ Flying Debris                    ☐ Pinch, Grab, Roll                    ☐ Internal Obstruction                    ☐ Oxygen Deficient  
☐ Engulfment                    ☐ Other (specify) \_\_\_\_\_

**\*Note:** The health effects of the contaminant(s) need to be discussed with the team prior to entry. Smoking is prohibited.

### Section 3: Lock-Out/Tag-Out/Isolation

Pipes/Valves                    ☐ Yes    ☐ No    ☐ N/A                    Pipes/valves closed, multiple locked, and tagged.                    Initials: \_\_\_\_\_  
   ☐ Yes    ☐ No    ☐ N/A                    Pipes blanked.                    Initials: \_\_\_\_\_  
   ☐ Yes    ☐ No    ☐ N/A                    Vents/drains blocked.                    Initials: \_\_\_\_\_  
Electrical                    ☐ Yes    ☐ No    ☐ N/A                    Switches / Lines off, multiple locked, and tagged.                    Initials: \_\_\_\_\_  
Mechanical                    ☐ Yes    ☐ No    ☐ N/A                    Pumps, motors and other mechanical devices off,  
   multiple locked, and tagged.                    Initials: \_\_\_\_\_  
Other: \_\_\_\_\_

### Section 4: Personal Protective/Safety Equipment Assessment

☐ Faceshield                    ☐ Alarm/Air Horn                    ☐ Airline/5 minute escape                    ☐ Tripod escape unit/hoist  
☐ Hard hat                    ☐ Signage, barricades, etc.                    ☐ Coveralls, other: \_\_\_\_\_                    ☐ Fire Extinguisher  
☐ Hearing protection                    ☐ Gloves, other: \_\_\_\_\_                    ☐ Spark Resistant Tools                    ☐ Fall Protection Device  
☐ Steel-toed shoes                    ☐ Tyvek suit                    ☐ Radios, telephone, etc.                    ☐ Intrinsic lighting & tools  
☐ Rubber boots                    ☐ PVC/Splash suit                    ☐ First Aid Kit                    ☐ Other: \_\_\_\_\_  
☐ Portable eyewash                    ☐ Air-purifying respirator                    ☐ Escape harness/lifeline                    ☐ Other: \_\_\_\_\_

**Note:** MN requires a hoist and harness for all Class II and III entries and otherwise for all permit-required entries greater than 5 feet. An eyewash is needed if the CS contains corrosives. OSHA requires a mechanical device to be available to retrieve personnel from vertical spaces more than 5 feet (1.52 meters) deep. A SCBA is required on standby for all MN Class III entries.

### Section 5: Air Monitoring

Test(s) Required	Instrument/Model & Serial Number	Permissible Entry Level	Date: Time:	Date: Time:	Date: Time:	Date: Time:	Date: Time:
% O <sub>2</sub>		≥ 19.5% and < 22.0%					
% LEL		< 10%					
ppm CO		< 35 PPM					
ppm H <sub>2</sub> S		< 5 PPM					
ppm VOC		See HASP					
Other							
Other							
<u>Equipment will be calibrated in accordance with manufacturers' guidelines.</u>		Tester's Initials:					

---

**Section 6: Authorized Entrants/Attendants within Permit Space**

---

I understand that I have reviewed this permit and know my job function and procedures necessary to accomplish this task safely.

Entrant	Signature	Time In	Time Out	Time In	Time Out	Time In	Time Out
Authorized Attendant	Signature	Time In	Time Out	Time In	Time Out	Time In	Time Out

---

**Section 7: Confined Space Certifications**

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Based on the hazard assessment, the following entry procedure will be followed:

☐ Non-Permit Entry                      ☐ Alternate Entry                      ☐ Permit Required Entry

I certify that all required precautions have been taken and necessary equipment and emergency response is provided for safety entry and work in this confined space:

Signature of Entry Supervisor Authorizing Entry    Date/Time                      \_\_\_\_\_

DURATION: This permit is approved for \_\_\_\_\_ hours on this day. Only the entry supervisor can extend this permit to a maximum of 12 hours.

---

**Section 8: Emergency Response Support for Permit Required Spaces**

---

IDLH Conditions are Present or Possible (Note: If Yes, then responders must be on site during entry.)    ☐ Yes    ☐ No

Name and Phone Number of Emergency Responders: \_\_\_\_\_

Called Responders to Brief and Confirm Availability:            ☐ Yes            ☐ No            ☐ Not Applicable

CRA Incident Reporting Hotline Number: 866-529-4886 See Responder Evaluation Form.

---

**Section 9: Task Completion and Permit Close-Out**

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Verification of System Line Restoration (Removal of locks, tags, blanks, blocks, etc. )                      ☐ Yes            ☐ No            ☐ N/A

I certify that this permit is finalized and closed out.

\_\_\_\_\_  
Entry Supervisor (Print and Sign Name)

\_\_\_\_\_  
Date/Time

*This Permit must be sent to Linda DiBartolomeis in Niagara Falls. Confined Space entry permits must be kept on file for a period of 1 year. If there are any questions, call the Regional Safety Manager. Copies may be placed in the project file if required.*

**CRA EVALUATION FORM  
FOR EMERGENCY RESCUE SERVICES  
IN PERMIT REQUIRED CONFINED SPACES**

Directions: This evaluation must be completed initially and then annually for sites and/or facilities which rely on community/local rescue services to provide emergency rescue services to their permit-required confined spaces. The rescue service should visit each site and/or facility to view all permit-required confined spaces and review their potential hazard(s). All questions must be answered satisfactorily in order to be able to list 911 on the CS permit and rely on the rescue service. It is acceptable to work with and assist rescue services in achieving a satisfactory evaluation.

Name of Service: \_\_\_\_\_

Contact's Name: \_\_\_\_\_

Emergency Phone No.: \_\_\_\_\_

Business Phone No.: \_\_\_\_\_

		Yes	No
1.	Does the rescue service have the ability, in terms of proficiency, with rescue-related tasks and equipment?	<input type="checkbox"/>	<input type="checkbox"/>
2.	Will the rescue service stand by (on site) at the permit space for IDLH or potential ILDH atmospheres? The cost for providing this service is \$_____.	<input type="checkbox"/>	<input type="checkbox"/>
3.	Can the rescue service respond in a 10 to 15-minute timeframe for non-IDLH situations (i.e., mechanical hazards that may cause broken bones, abrasions, etc.)? The availability of the rescue service is (i.e., 24 hours a day or are there times when key personnel would not be available)? _____	<input type="checkbox"/>	<input type="checkbox"/>
4.	Does the rescue service:		
	A. Provide all required PPE and equipment that may be needed at the site and/or facility? If no, CRA will provide. _____.	<input type="checkbox"/>	<input type="checkbox"/>
	B. Train rescue personnel annually in accordance with the standard?	<input type="checkbox"/>	<input type="checkbox"/>
5.	Will the rescue service commit to providing rescue services to the site and/or facility?	<input type="checkbox"/>	<input type="checkbox"/>
6.	Is there an adequate method of communication between the attendant and rescue service to summon help?	<input type="checkbox"/>	<input type="checkbox"/>
7.	Has the rescue service practiced rescues or successfully performed a permit space rescue within the last 12 months?	<input type="checkbox"/>	<input type="checkbox"/>

Evaluation Completed By:

\_\_\_\_\_  
Name (Print)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



## SAFETY INSPECTION CHECKLIST - MOBILE EQUIPMENT SAFETY

Week Ending: _____		Job No.: _____		Equipment: _____					
(This form is to be completed daily by the operator. Deficiencies should be addressed immediately.)									
Superintendent: _____									
	<b>Date:</b>	<b>Mon.</b>	<b>Tues.</b>	<b>Wed.</b>	<b>Thurs.</b>	<b>Fri.</b>	<b>Sat.</b>	<b>Sun.</b>	<b>Comments</b>
<b>Equipment Hours:</b>									
	<b>Start:</b>								
	<b>Stop:</b>								
<b>Fluid Levels:</b>									
	Oil								
	Hydraulic								
	Transmission								
	Radiator								
	Grease Fittings								
	Fuel								
<b>Safety Checks:</b>									
	Fire Extinguisher								
	Seat and Safety Belts								
	Warning Devices (backup alarms, lights, etc.)								
	Housekeeping								
	Brakes								
	Mirrors								
	Windshield and Wipers								
	Steering								
	Horn								
	Lights								
	Tires								
	Guards								
	Instruments								
	Exhaust System								
<b>Accessories:</b>									
	Boom or Mast								
	Controls								
	Level Indicators								
	Tracks								
	Other								
<b>Sign-Off:</b>									
	Operator's Initials								
	Supervisor's Initials								

Additional Comments: (Please write any additional comments here. Use the back of this form if necessary.)

√ = OK

NR = Needs Repair

NA = Not Applicable

## SAFETY INSPECTION CHECKLIST FOR EXCAVATIONS REFERENCED BY OSHA STANDARDS

This checklist is to be completed by the competent person at the start of work and as needed throughout the shift (i.e., after rain events, etc.). *(A competent person has been trained in the current OSHA excavation standard, is knowledgeable about soil analysis and protective systems, and has the authority to shut down the job.)*

Site Location: _____	Project #: _____
Date: _____ Time: _____	Competent Person: _____
Were visual soil tests made? If Yes, what type? _____	YES <input type="checkbox"/> NO <input type="checkbox"/> Type: _____
Were manual soil tests made? If yes, what type? _____	YES <input type="checkbox"/> NO <input type="checkbox"/> Type: _____
Soil Type: _____	Signature: _____
Soil Classification: _____	
Excavation Depth: _____	Excavation Width: _____
Protective System Used: _____	

In the following table, please place a Y for Yes, N for No, or N/A for Not Applicable in the right hand column for each item. If No, place the date of correction.

<i>Subject</i>		<i>Y, N, or NA</i>	<i>Date Corrected</i>
<b>GENERAL INSPECTION OF THE JOB SITE</b>			
1.	Does the competent person have the authority to remove employees from the excavation immediately?		
2.	Are surface obstructions removed or supported?		
3.	Are employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation?		
4.	Are hard hats worn by all employees?		
5.	Are excavated soil, materials, and equipment placed at least 2 feet from the edge of the excavation?		
6.	Are walkways and bridges over excavations 4 feet or more in depth equipped with standard guardrails and toe-boards?		
7.	Are warning vests or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic?		
8.	Are employees required to stand away from vehicles being loaded or unloaded?		
9.	Is a warning system established and used when mobile equipment operates near the edge of the excavation?		
10.	Are employees prohibited from going beneath suspended loads?		
11.	Are employees prohibited from working on the faces of sloped or benched excavations above other employees?		
<b>UTILITIES</b>			
12.	Were utility companies contacted and/or utilities located?		
13.	Are the exact locations of the utilities marked?		
14.	Are underground installations protected, supported, or removed when excavation is opened?		
<b>MEANS OF ENTERING AND EXITING THE TRENCH</b>			
15.	Is the distance along the trench to an exit no greater than 25 feet in excavations 4 feet or more in depth?		

<i>Subject</i>		<i>Y, N, or NA</i>	<i>Date Corrected</i>
16.	Is a support system, such as underpinning, being used?		
17.	Are ladders used in excavations secured and extended 3 feet above edge of the trench?		
18.	Are structural ramps used by employees designed by a competent person?		
19.	Are structural ramps used for equipment designed by a registered professional engineer?		
20.	Are employees protected from cave-ins when entering or exiting the excavation?		
<b>WET CONDITIONS</b>			
21.	Is water removal equipment monitored by a competent person?		
22.	Is surface water or runoff diverted or controlled to prevent accumulation in the excavation?		
23.	Are inspections made after every rainstorm or other hazard-increasing occurrence?		
<b>HAZARDOUS ATMOSPHERE</b>			
24.	Is the atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficiency, combustible, or other harmful contaminant exposing employees to a hazard?		
25.	Are adequate precautions taken to protect employees from exposure to an atmosphere containing less than 19.5% oxygen and/or other hazardous atmospheres?		
26.	Is ventilation provided to prevent employee exposure to an atmosphere containing flammable gas 10% above the lower explosive limit of a gas?		
27.	Is testing conducted often to ensure that the atmosphere remains safe?		
28.	Is emergency equipment, such as breathing apparatus, safety harness and lifeline, and/or basket stretcher readily available where hazardous atmospheres could or do exist?		
<b>SUPPORT SYSTEMS</b>			
29.	Are materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads?		
30.	Are materials and equipment used for protective systems inspected and in good condition?		
31.	Are protective systems installed without exposing employees to the hazards of cave-ins (including end walls), collapses, or threat of being struck by materials or equipment?		
32.	Are excavations below the level of the base, or footing supported, approved by a registered professional engineer?		
33.	Does the removal of support systems progress from the bottom and members are released slowly? Note any indication of possible failure.		
34.	Is the excavation of material a level no greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth?		
35.	Is there a shield system placed to prevent lateral movement?		

## APPENDIX B

### **INVESTIGATION JSAs**

JSA TEMPLATE (BLANK)

FLUID LEVEL MONITORING

DECONTAMINATION OF SAMPLING EQUIPMENT AND PERSONNEL (PPE LEVEL D)

GROUNDWATER SAMPLING - BAILER

GROUNDWATER SAMPLING - PERISTALTIC PUMP

GROUNDWATER SAMPLING WITH BLADDER PUMP

LANDFILL GAS MONITORING



# JOB SAFETY ANALYSIS (JSA)

Title



Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	[Date of review/revision]	JSA Type:	[Construction/Office Work/O&M/Drilling/Maintenance/Demolition/Decommissioning]
Work Type:	[Environmental/Remediation/Construction/General Industry]	Client:	
Work Activity:			
Work Site:	[Site information and address]		
Key Equipment:			
Task-specific Training:	[Identify any special/additional training necessary to safely complete this task]		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
<input type="checkbox"/> Reflective Vest	<input type="checkbox"/> Goggles	<input type="checkbox"/> Gloves*	Supplied Air	APR	
<input type="checkbox"/> Hard Hat	<input type="checkbox"/> Face Shield*	<input type="checkbox"/> Coveralls*	<input type="checkbox"/> SCBA	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Particulate <input type="checkbox"/> Organic Vapor
<input type="checkbox"/> Lifeline/Harness*	<input type="checkbox"/> Hearing Protection*	<input type="checkbox"/> PPE Clothing*	<input type="checkbox"/> Airline Respirator (attach description)	<input type="checkbox"/> Half Mask APR	<input type="checkbox"/> Particulate/Organic Vapor Combined
<input type="checkbox"/> Safety Glasses	<input type="checkbox"/> Safety-toed Boots				<input type="checkbox"/> Acid Gas
<input type="checkbox"/> Other*		<input type="checkbox"/> Other*		<input type="checkbox"/> Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					



# JOB SAFETY ANALYSIS (JSA)

Title



Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Corrective Measure(s) <sup>(3)</sup>	Person Responsible
1		•	•	
2		•	•	
3		•	•	

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



## JOB SAFETY ANALYSIS (JSA)

### Fluid Level Monitoring



Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

<b>Date Issued/Revised:</b>	3-1-09	<b>JSA Type:</b>	Fluid Level Monitoring
<b>Work Type:</b>	Environmental	<b>Client:</b>	Weyerhaeuser Company
<b>Work Activity:</b>	Fluid level monitoring (collecting water/LNAPL levels/gauging wells)		
<b>Work Site:</b>	12 <sup>th</sup> Street Landfill, Otsego, Michigan and Former Plainwell Paper Mill –220 Allegan Street, Plainwell, Michigan		
<b>Key Equipment:</b>	Water level meter, PPE		
<b>Task-specific Training:</b>	Fluid Level Monitoring; reference HASP for additional site/client safety training requirements		

<b>MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)</b>					
<input checked="" type="checkbox"/> Reflective Vest	<input type="checkbox"/> Goggles	<input checked="" type="checkbox"/> Gloves*	<b>Supplied Air</b>	<b>APR</b>	
<input checked="" type="checkbox"/> Hard Hat	<input type="checkbox"/> Face Shield*	<input type="checkbox"/> Coveralls*	<input type="checkbox"/> SCBA	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Particulate <input type="checkbox"/> Organic Vapor
<input type="checkbox"/> Lifeline/Harness*	<input checked="" type="checkbox"/> Hearing Protection*	<input type="checkbox"/> PPE Clothing*	<input type="checkbox"/> Airline Respirator (attach description)	<input type="checkbox"/> Half Mask APR	<input type="checkbox"/> Particulate/Organic Vapor Combined
<input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Safety-toed Boots				<input type="checkbox"/> Acid Gas
<input type="checkbox"/> Other*		<input type="checkbox"/> Other*		<input type="checkbox"/> Other*	
<b>ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)</b>					
Use nitrile gloves when performing work; use hearing protection as necessary based on site conditions					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
Jodie Dembowski		Project Coordinator				



## JOB SAFETY ANALYSIS (JSA)

### Fluid Level Monitoring



Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Corrective Measure(s) <sup>(3)</sup>	Person Responsible
1	Inspect/calibrate equipment	<ul style="list-style-type: none"><li>Loss due to malfunctioning equipment</li></ul>	<ul style="list-style-type: none"><li>Check all equipment to ensure it is in proper working order and has been calibrated to CRA and manufacturer's standards, then document</li></ul>	Sampling Technician
2	Establish work zone at monitoring well location	<ul style="list-style-type: none"><li>Traffic</li><li>Pinch points</li><li>Lifting hazards</li><li>Back injury</li><li>Manual material handling</li></ul>	<ul style="list-style-type: none"><li>Maintain awareness of on-site traffic patterns and walking paths</li><li>Reduce travel distance when there is a need to carry/lift materials</li><li>Make sure grip is adequate; wear leather/cotton gloves</li><li>Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required</li><li>Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position</li><li>Avoid one-handed carrying if possible; maintain awareness of footing</li></ul>	Sampling Technician
3	Open monitoring well cover(s)	<ul style="list-style-type: none"><li>Pinch points</li><li>Hand injury</li><li>Biological hazards</li></ul>	<ul style="list-style-type: none"><li>Avoid placing hands in pinch points</li><li>Wear proper PPE (gloves) for task and use the proper tool(s) when opening well covers (open face wrench/socket wrench).</li><li>Inspect for other hazards that may affect the hands (hypodermic needles, etc.)</li><li>Heightened awareness of wasps, ants, bees, spiders, and poison plants</li></ul>	Sampling Technician
4	Measure water	<ul style="list-style-type: none"><li>Contaminant exposure</li><li>Cross contamination</li></ul>	<ul style="list-style-type: none"><li>Wear proper PPE (Ndex nitrile gloves)</li><li>Decon probe and measuring tape following gauging of well</li></ul>	Sampling Technician
5	Close monitoring well cover	<ul style="list-style-type: none"><li>Traffic</li><li>Hand injury</li><li>Pinch points</li></ul>	<ul style="list-style-type: none"><li>Maintain awareness of on-site traffic patterns; verify barricades are still in place</li><li>Wear appropriate gloves and use proper tool(s)</li><li>Avoid placing hands in pinch points</li></ul>	Sampling Technician

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".





## JOB SAFETY ANALYSIS (JSA)

### Decontamination of Sampling Equipment and Personnel (PPE Level D)



Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

<b>Date Issued/Revised:</b>	3-1-09	<b>JSA Type:</b>	Decontamination
<b>Work Type:</b>	Environmental	<b>Client:</b>	Weyerhaeuser Company
<b>Work Activity:</b>	Decontamination of sampling equipment and personnel (PPE Level D)		
<b>Work Site:</b>	12 <sup>th</sup> Street Landfill, Otsego, Michigan		
<b>Key Equipment:</b>	Alconox/Liquinox, brushes		
<b>Task-specific Training:</b>	Decontamination/Site Control; Quality Control/Sampling Plan		

#### MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)

<input checked="" type="checkbox"/> Reflective Vest	<input type="checkbox"/> Goggles	<input checked="" type="checkbox"/> Gloves*	<b>Supplied Air</b>	<b>APR</b>	
<input checked="" type="checkbox"/> Hard Hat	<input type="checkbox"/> Face Shield*	<input type="checkbox"/> Coveralls*	<input type="checkbox"/> SCBA	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Particulate <input type="checkbox"/> Organic Vapor
<input type="checkbox"/> Lifeline/Harness*	<input type="checkbox"/> Hearing Protection*	<input type="checkbox"/> PPE Clothing*	<input type="checkbox"/> Airline Respirator (attach description)	<input type="checkbox"/> Half Mask APR	<input type="checkbox"/> Particulate/Organic Vapor Combined
<input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Safety-toed Boots				<input type="checkbox"/> Acid Gas
<input type="checkbox"/> Other*		<input type="checkbox"/> Other*		<input type="checkbox"/> Other*	

#### ADDITIONAL PPE (\*provide specific type(s) or descriptions of this item below)

Nitrile gloves to be worn when decontaminating reusable equipment

Upgrade/down grade of PPE will be based on action levels in Tables 5.1 and 5.2 of HASP.

Please refer to Section 5.0 of the HASP for additional PPE information

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
Leah Pabst		Environmental Scientist				April 2012



## JOB SAFETY ANALYSIS (JSA)

### Decontamination of Sampling Equipment and Personnel (PPE Level D)



Safety Means Awareness  
Responsibility Teamwork

Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Corrective Measure(s) <sup>(3)</sup>	Person Responsible
1	Decontamination of sampling equipment to include pumps, bailers, tubing, etc.	<ul style="list-style-type: none"><li>Contaminant exposure</li><li>Pinch points</li><li>Slip/trip/hit/fall hazards</li><li>Lifting hazards</li><li>Back injury</li><li>Manual material handling</li></ul>	<ul style="list-style-type: none"><li>Wear appropriate PPE during decon activities (nitrile gloves)</li><li>Avoid putting hands in or near pinch points</li><li>Maintain good housekeeping and be aware of surroundings</li><li>Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical means, such as a dolly, cart, or a buddy lift) will be required</li><li>Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position</li><li>Refer to the HASP for additional lifting techniques</li></ul>	Sampling Technician / All Field Crews
2	Decontamination of personnel	<ul style="list-style-type: none"><li>Contaminant exposure</li><li>Slip/trip/hit/fall hazards</li></ul>	<ul style="list-style-type: none"><li>Dispose of used PPE in accordance with site requirements</li><li>Wash hands and face before eating, drinking, or using tobacco products</li><li>Take care when removing PPE (boots, gloves, etc.); sit down to remove/change boots as necessary</li></ul>	Sampling Technician / All Field Crews
3	Management of waste derived from decontamination activities	<ul style="list-style-type: none"><li>Contaminant exposure</li><li>Lifting hazards</li><li>Back injury</li><li>Manual material handling</li></ul>	<ul style="list-style-type: none"><li>Containerize decon waste (water, used PPE, etc) as required</li><li>Refer to step 1 and the HASP for additional lifting information</li></ul>	Sampling Technician / All Field Crews

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



## JOB SAFETY ANALYSIS (JSA) Groundwater Sampling (Bailer)



Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

<b>Date Issued/Revised:</b>	3-1-09	<b>JSA Type:</b>	Groundwater Sampling
<b>Work Type:</b>	Environmental	<b>Client:</b>	Weyerhaeuser Company
<b>Work Activity:</b>	Groundwater sampling		
<b>Work Site:</b>	12 <sup>th</sup> Street Landfill, Otsego, Michigan		
<b>Key Equipment:</b>	Bailer; safety cones/barricades		
<b>Task-specific Training:</b>	Groundwater Sampling Procedures – reference HASP for additional site/client safety training requirements.		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)						
<input checked="" type="checkbox"/> Reflective Vest	<input type="checkbox"/> Goggles	<input checked="" type="checkbox"/> Gloves*	Supplied Air		APR	
<input checked="" type="checkbox"/> Hard Hat	<input type="checkbox"/> Face Shield*	<input type="checkbox"/> Coveralls*	<input type="checkbox"/> SCBA		<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Particulate <input type="checkbox"/> Organic Vapor
<input type="checkbox"/> Lifeline/Harness*	<input checked="" type="checkbox"/> Hearing Protection*	<input type="checkbox"/> PPE Clothing*	<input type="checkbox"/> Airline Respirator (attach description)		<input type="checkbox"/> Half Mask APR	<input type="checkbox"/> Particulate/Organic Vapor Combined
<input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Safety-toed Boots					<input type="checkbox"/> Acid Gas
<input checked="" type="checkbox"/> Other*	Sunscreen and Insect Repellant		<input type="checkbox"/> Other*		<input type="checkbox"/> Other*	
<b>ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)</b>						
Use Ndex nitrile gloves when handling wet sampling containers; use abrasion/cut-resistant gloves for other tasks; use hearing protection as necessary based on site conditions.						
Upgrade/down grade of PPE will be based on action levels in Tables 5.1 and 5.2 of HASP.						
Please refer to Section 5.0 of the HASP for additional PPE information						

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
Leah Pabst		Environmental Scientist				April 2012



# JOB SAFETY ANALYSIS (JSA)

## Groundwater Sampling (Bailer)



Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Corrective Measure(s) <sup>(3)</sup>	Person Responsible
1	Inspect/calibrate sampling equipment	<ul style="list-style-type: none"> <li>Loss due to malfunctioning equipment</li> </ul>	<ul style="list-style-type: none"> <li>Check all equipment (meters) to ensure it is in proper working order and has been calibrated to CRA and manufacturer's standards, and document</li> </ul>	Sampling Technician
2	Establish work zone at monitoring well location	<ul style="list-style-type: none"> <li>Traffic</li> <li>Pinch points</li> <li>Lifting hazards</li> <li>Back injury</li> <li>Manual material handling</li> </ul>	<ul style="list-style-type: none"> <li>Maintain awareness of on-site traffic patterns and walking paths; setup barricades</li> <li>Reduce travel distance when there is a need to carry/lift materials</li> <li>Make sure grip is adequate; wear leather/cotton gloves when setting up barricades</li> <li>Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required</li> <li>Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position</li> <li>Avoid one-handed carrying if possible; maintain awareness of footing</li> </ul>	Sampling Technician
3	Open monitoring well cover(s)	<ul style="list-style-type: none"> <li>Pinch points</li> <li>Hand injury</li> <li>Biological hazards</li> </ul>	<ul style="list-style-type: none"> <li>Avoid placing hands in pinch points</li> <li>Wear proper PPE (gloves) for task and use the proper tool(s) when opening well covers (open face wrench/socket wrench)</li> <li>Inspect for other hazards that may affect the hands (hypodermic needles, etc.)</li> <li>Heightened awareness of wasps, ants, bees, spiders, and poison plants</li> </ul>	Sampling Technician
4	Measure water levels	<ul style="list-style-type: none"> <li>Contaminant exposure</li> <li>Cross contamination</li> </ul>	<ul style="list-style-type: none"> <li>Wear proper PPE (Ndex nitrile gloves)</li> <li>Decon probe and measuring tape following gauging of well</li> </ul>	Sampling Technician
5	Develop/purge monitoring well location - bailer	<ul style="list-style-type: none"> <li>Slip/trip/fall hazards</li> <li>Cuts</li> <li>Pinch points</li> <li>Back and shoulder strain</li> </ul>	<ul style="list-style-type: none"> <li>Maintain housekeeping; be aware of ground conditions</li> <li>Use PPE and proper tools</li> <li>Keep hands away from pinch points</li> <li>Stretch affected muscles (triceps, back, neck, and shoulder) prior to/during/after activity</li> <li>Avoid repetitive motions and overhead lifts; use proper lifting techniques and neutral postures and take breaks</li> </ul>	Sampling Technician
6	Collect groundwater sample utilizing bailer	<ul style="list-style-type: none"> <li>Chemical exposure</li> <li>Cuts from container breaking</li> <li>Sample misidentification</li> </ul>	<ul style="list-style-type: none"> <li>Wear proper PPE</li> <li>Inspect bottles for signs of breakage/damage; do not use suspect containers</li> <li>Close glass bottles carefully – avoid cross threading lid and bottle</li> <li>Ensure sample id numbers match sample location/site plan</li> <li>Check sample labels for accuracy prior to placing in container</li> </ul>	Sampling Technician
7	Close monitoring well cover	<ul style="list-style-type: none"> <li>Traffic</li> <li>Hand injury</li> <li>Pinch points</li> </ul>	<ul style="list-style-type: none"> <li>Maintain awareness of on-site traffic patterns; verify barricades are still in place</li> <li>Wear appropriate gloves and use proper tool(s)</li> <li>Avoid placing hands in pinch points</li> </ul>	Sampling Technician
8	Pack samples in container (i.e., cooler)	<ul style="list-style-type: none"> <li>Bottle breakage</li> <li>Chemical exposure</li> <li>Lifting hazards</li> <li>Back injury</li> <li>Manual material handling</li> <li>Lost time due to sampling error</li> </ul>	<ul style="list-style-type: none"> <li>Pack glass containers in bubble wrap or equivalent protection</li> <li>Wear appropriate PPE (Ndex nitrile gloves)</li> <li>Refer to step 2 and the HASP for additional lifting techniques/information</li> <li>Ensure samples are packed/labeled/shipped correctly – double check</li> </ul>	Sampling Technician



## JOB SAFETY ANALYSIS (JSA)

### Groundwater Sampling (Bailer)



Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Corrective Measure(s) <sup>(3)</sup>	Person Responsible
9	Manage any investigative derived waste (IDW)	<ul style="list-style-type: none"><li>• Chemical exposure</li><li>• Pinch points</li><li>• Slip/trip/fall hazards</li><li>• Lifting hazards</li><li>• Back injury</li><li>• Manual material handling</li><li>• Mislabeling waste</li></ul>	<ul style="list-style-type: none"><li>• Wear appropriate PPE (Ndex gloves) and work gloves</li><li>• Avoid pinch points</li><li>• Use proper PPE</li><li>• Inspect for proper housekeeping; clean up work area</li><li>• Refer to step 2 and the HASP for additional lifting techniques/information</li><li>• Label IDW appropriately (generator, contact number, identification of contents, and site location); specify type of contents; arrange for disposal</li></ul>	Sampling Technician and Project Manager

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



## JOB SAFETY ANALYSIS (JSA)

### Groundwater Sampling (Peristaltic Pump)



Safety Means Awareness  
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

<b>Date Issued/Revised:</b>	3-1-09	<b>JSA Type:</b>	Groundwater Sampling
<b>Work Type:</b>	Environmental	<b>Client:</b>	Weyerhaeuser Company
<b>Work Activity:</b>	Groundwater sampling		
<b>Work Site:</b>	12 <sup>th</sup> Street Landfill, Otsego Michigan		
<b>Key Equipment:</b>	Peristaltic pump		
<b>Task-specific Training:</b>	Electrical Safety, Groundwater Sampling Procedures – reference HASP for additional site/client safety training requirements.		

<b>MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)</b>					
<input checked="" type="checkbox"/> Reflective Vest	<input type="checkbox"/> Goggles	<input checked="" type="checkbox"/> Gloves*	<b>Supplied Air</b>	<b>APR</b>	
<input checked="" type="checkbox"/> Hard Hat	<input type="checkbox"/> Face Shield*	<input type="checkbox"/> Coveralls*	<input type="checkbox"/> SCBA	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Particulate <input type="checkbox"/> Organic Vapor
<input type="checkbox"/> Lifeline/Harness*	<input checked="" type="checkbox"/> Hearing Protection*	<input type="checkbox"/> PPE Clothing*	<input type="checkbox"/> Airline Respirator (attach description)	<input type="checkbox"/> Half Mask APR	<input type="checkbox"/> Particulate/Organic Vapor Combined
<input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Safety-toed Boots				<input type="checkbox"/> Acid Gas
<input checked="" type="checkbox"/> Other*	Sunscreen and Insect Repellant	<input type="checkbox"/> Other*		<input type="checkbox"/> Other*	
<b>ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)</b>					
Use Ndex nitrile gloves when handling wet sampling containers; use abrasion/cut-resistant gloves for other tasks; use hearing protection as necessary based on site conditions.					
<b>Upgrade/down grade of PPE will be based on action levels in Tables 5.1 and 5.2 of HASP.</b>					
<b>Please refer to Section 5.0 of the HASP for additional PPE information</b>					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
Leah Pabst		Environmental Scientist				April 2012



# JOB SAFETY ANALYSIS (JSA)

## Groundwater Sampling (Peristaltic Pump)



Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Corrective Measure(s) <sup>(3)</sup>	Person Responsible
1	Inspect/calibrate sampling equipment	<ul style="list-style-type: none"> <li>Loss due to malfunctioning equipment</li> </ul>	<ul style="list-style-type: none"> <li>Check all equipment to ensure it is in proper working order and has been calibrated to CRA and manufacturer's standards, and document</li> </ul>	Sampling Technician
2	Establish work zone at monitoring well location	<ul style="list-style-type: none"> <li>Traffic</li> <li>Pinch points</li> <li>Lifting hazards</li> <li>Back injury</li> <li>Manual material handling</li> </ul>	<ul style="list-style-type: none"> <li>Maintain awareness of on-site traffic patterns and walking paths; setup barricades</li> <li>Reduce travel distance when there is a need to carry/lift materials</li> <li>Make sure grip is adequate; wear leather/cotton gloves when setting up barricades</li> <li>Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required</li> <li>Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position</li> <li>Avoid one-handed carrying if possible; maintain awareness of footing</li> </ul>	Sampling Technician
3	Open monitoring well cover(s)	<ul style="list-style-type: none"> <li>Pinch points</li> <li>Hand injury</li> <li>Biological hazards</li> </ul>	<ul style="list-style-type: none"> <li>Avoid placing hands in pinch points</li> <li>Wear proper PPE (gloves) for task and use the proper tool(s) when opening well covers (open face wrench/socket wrench)</li> <li>Inspect for other hazards that may affect the hands (hypodermic needles, etc.)</li> <li>Heightened awareness of wasps, ants, bees, spiders, and poison plants</li> </ul>	Sampling Technician
4	Measure water levels	<ul style="list-style-type: none"> <li>Contaminant exposure</li> <li>Cross contamination</li> </ul>	<ul style="list-style-type: none"> <li>Wear proper PPE (Ndex nitrile gloves)</li> <li>Decon probe and measuring tape following gauging of well</li> </ul>	Sampling Technician
5	Develop/purge monitoring well location – peristaltic pump	<ul style="list-style-type: none"> <li>Slip/trip/fall hazards</li> <li>Cuts</li> <li>Pinch points</li> <li>Electrical (AC or DC)</li> <li>Back and shoulder strain</li> </ul>	<ul style="list-style-type: none"> <li>Maintain housekeeping; be aware of ground conditions</li> <li>Use PPE and proper tools</li> <li>Keep hands away from pinch points</li> <li>Inspect wiring, clamps, cables, etc.; avoid arcing</li> <li>Stretch affected muscles (triceps, back, neck, and shoulder) prior to/during/after activity</li> </ul>	Sampling Technician
6	Collect groundwater sample utilizing a peristaltic pump	<ul style="list-style-type: none"> <li>Chemical exposure</li> <li>Cuts from container breaking</li> <li>Sample misidentification</li> </ul>	<ul style="list-style-type: none"> <li>Wear proper PPE</li> <li>Inspect bottles for signs of breakage/damage; do not use suspect containers</li> <li>Close glass bottles carefully – avoid cross threading lid and bottle</li> <li>Ensure sample id numbers match sample location/site plan</li> <li>Check sample labels for accuracy prior to placing in container</li> </ul>	Sampling Technician
7	Close monitoring well cover	<ul style="list-style-type: none"> <li>Traffic</li> <li>Hand injury</li> <li>Pinch points</li> </ul>	<ul style="list-style-type: none"> <li>Maintain awareness of on-site traffic patterns; verify barricades are still in place</li> <li>Wear appropriate gloves and use proper tool(s)</li> <li>Avoid placing hands in pinch points</li> </ul>	Sampling Technician
8	Pack samples in container (i.e., cooler)	<ul style="list-style-type: none"> <li>Bottle breakage</li> <li>Chemical exposure</li> <li>Lifting hazards</li> <li>Back injury</li> <li>Manual material handling</li> <li>Lost time due to sampling error</li> </ul>	<ul style="list-style-type: none"> <li>Pack glass containers in bubble wrap or equivalent protection</li> <li>Wear appropriate PPE (Ndex nitrile gloves)</li> <li>Refer to step 2 and the HASP for additional lifting techniques/information</li> <li>Ensure samples are packed/labeled/shipped correctly – double check</li> </ul>	Sampling Technician



## JOB SAFETY ANALYSIS (JSA)

### Groundwater Sampling (Peristaltic Pump)



Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Corrective Measure(s) <sup>(3)</sup>	Person Responsible
9	Manage any investigative derived waste (IDW)	<ul style="list-style-type: none"><li>• Chemical exposure</li><li>• Pinch points</li><li>• Slip/trip/fall hazards</li><li>• Lifting hazards</li><li>• Back injury</li><li>• Manual material handling</li><li>• Mislabeling waste</li></ul>	<ul style="list-style-type: none"><li>• Wear appropriate PPE (Ndex gloves) and work gloves</li><li>• Avoid pinch points</li><li>• Use proper PPE</li><li>• Inspect for proper housekeeping; clean up work area</li><li>• Refer to step 2 and the HASP for additional lifting techniques/information</li><li>• Label IDW appropriately (generator, contact number, identification of contents, and site location); specify type of contents; arrange for disposal</li></ul>	Sampling Technician and Project Manager

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".





## JOB SAFETY ANALYSIS (JSA)

### Groundwater Sampling with Bladder Pump



Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**. **Review this JHA initially and in the field prior to initiating the job, using the COP RM&R "Go Card" to assist in identifying specific site hazards. Document by "dirtying" this JHA.**

<b>Date Issued/Revised:</b>	4-19-12	<b>JSA Type:</b>	Groundwater Sampling
<b>Work Type:</b>	Environmental	<b>Client:</b>	Weyerhaeuser Company
<b>Work Activity:</b>	Groundwater Sampling		
<b>Work Site:</b>	12 <sup>TH</sup> Street Landfill, Otsego, Michigan		
<b>Key Equipment:</b>	Bladder pump, nitrogen, flow through cell, water level meter, nitrogen air regulator and air hose.		
<b>Task-specific Training:</b>	Water level meter, pumps, sample collection, sample packaging and shipping.		

<b>MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)</b>					
<input type="checkbox"/> Reflective Vest	<input type="checkbox"/> Goggles	<input checked="" type="checkbox"/> Gloves*	<b>Supplied Air</b>	<b>APR</b>	
<input checked="" type="checkbox"/> Hard Hat	<input type="checkbox"/> Face Shield*	<input checked="" type="checkbox"/> Coveralls*	<input type="checkbox"/> SCBA	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Particulate <input type="checkbox"/> Organic Vapor
<input type="checkbox"/> Lifeline/Harness*	<input type="checkbox"/> Hearing Protection*	<input checked="" type="checkbox"/> PPE Clothing*	<input type="checkbox"/> Airline Respirator (attach description)	<input type="checkbox"/> Half Mask APR	<input type="checkbox"/> Particulate/Organic Vapor Combined
<input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Safety-toed Boots				<input type="checkbox"/> Acid Gas
<input checked="" type="checkbox"/> Other*	Insect repellent with sun screen	<input type="checkbox"/> Other*		<input type="checkbox"/> Other*	
<b>ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)</b>					
Use Ndex nitrile gloves when handling wet sampling containers; use abrasion/cut-resistant gloves for other tasks; use hearing protection as necessary based on site conditions.					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					



# JOB SAFETY ANALYSIS (JSA)

## Groundwater Sampling with Bladder Pump



Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Mitigating Measure(s) <sup>(3)</sup>	Person Responsible
1	Coordinate site access	<ul style="list-style-type: none"> <li>Delays or added work</li> </ul>	<ul style="list-style-type: none"> <li>Notify Station Manager of schedule</li> <li>Notify other required personnel if applicable (city, regulators, private property owners, etc.)</li> </ul>	Project Manager
2	Mobilize with proper equipment/supplies for sampling	<ul style="list-style-type: none"> <li>Delay or improper/unsafe performance of work due to improper equipment on site</li> <li>Cross-contamination of wells</li> </ul>	<ul style="list-style-type: none"> <li>Review work plan to determine equipment/supply needs</li> <li>Make sure all sampling/gauging equipment is decontaminated</li> <li>Bring ice for sample storage</li> <li>Review the HASP and gather necessary PPE</li> </ul>	Sampling Technician
3	Notify other personnel on site	<ul style="list-style-type: none"> <li>Unknown traffic or other work hazards</li> <li>Lack of communication between all interested parties</li> <li>Biological hazards (spiders, snakes, chiggers, ticks, bees, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Meet with station attendant or other site personnel and explain planned activities</li> <li>Inspect area for potential biological hazards. Chigger habitat (high grass, thick brush, especially in summer). If chiggers are suspected, take the following precautions: tuck in pant legs, apply insect repellent containing minimum of 25% DEET to boots, pant legs, and outer clothing generally. After potential exposure in chigger infested area, use proper hygiene practices and shower as soon as practicable (i.e., as soon as arriving home). Wash clothes prior to wearing again.</li> </ul>	Sampling Technician
4	Determine sampling order	<ul style="list-style-type: none"> <li>Cross-contamination of samples and wells due to incomplete decontamination of sampling equipment</li> </ul>	<ul style="list-style-type: none"> <li>Review prior analytical results and set sampling order from lowest to highest concentration wells</li> </ul>	Sampling Technician
5	Perform STAR and tailgate safety meeting upon arrival at site	<ul style="list-style-type: none"> <li>Consider worst-case scenario (including weather conditions)</li> </ul>	<ul style="list-style-type: none"> <li>Review HASP with co-workers</li> <li>Highlight aspects identified by HASP and, if necessary, add to HASP</li> <li>Get signature of all co-workers on HASP</li> </ul>	Sampling Technician
6	Set up exclusion zone(s)	<ul style="list-style-type: none"> <li>Injury or exposure to public or other on-site personnel</li> <li>Slip/trip/fall hazards</li> </ul>	<ul style="list-style-type: none"> <li>Implement exclusion zone setup instructions of the HASP (barricades, caution tape, cones, etc.)</li> <li>Glove approved by the ANSI Cut and Abrasion Resistance Level 2 EN 388 21xx Testing Standard</li> <li>Set up work area free of trip hazards</li> </ul>	Sampling Technician
7	Gauge water levels and product thickness (where applicable) in wells	<ul style="list-style-type: none"> <li>Back strain</li> <li>Inhalation or dermal exposure to chemical hazards</li> </ul>	<ul style="list-style-type: none"> <li>Wear Ndex nitrile gloves over top of a glove approved by the ANSI Cut and Abrasion Resistance Level 2 EN 388 21xx Testing Standard</li> <li>initiate air quality monitoring in accordance with the HASP</li> <li>Maintain safe distance from well head</li> <li>Bend at knees, not waist</li> </ul>	Sampling Technician



# JOB SAFETY ANALYSIS (JSA)

## Groundwater Sampling with Bladder Pump



Safety Means Awareness  
Responsibility Teamwork

Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Mitigating Measure(s) <sup>(3)</sup>	Person Responsible
8	Purge well(s) and collect purge water	<ul style="list-style-type: none"> <li>• Cross-contamination</li> <li>• Lifting hazards</li> <li>• Back injury</li> <li>• Manual material handling</li> <li>• Inhalation or dermal exposure to chemicals</li> <li>• Slip/trip/fall hazards</li> <li>• Spilling contaminated water</li> <li>• Nitrogen tanks</li> </ul>	<ul style="list-style-type: none"> <li>• Decontaminate purging equipment between each sampling location</li> <li>• Wear Ndex nitrile gloves over top of a glove approved by the ANSI Cut and Abrasion Resistance Level 2 EN 388 21xx Testing Standard</li> <li>• Reduce travel distance when there is a need to carry/lift materials</li> <li>• Make sure grip is adequate; wear leather/cotton gloves</li> <li>• Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required</li> <li>• Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position</li> <li>• Avoid one-handed carrying if possible; maintain awareness of footing</li> <li>• Use PPE and monitoring in accordance with the HASP</li> <li>• Keep work area clear of tripping or slipping hazards</li> <li>• Store purge water in appropriate containers</li> <li>• Transport and store nitrogen tanks in accordance with DOT regulatory requirements</li> <li>• Inspect all air lines and fittings prior to pressurizing hoses</li> <li>• Release pressure slowly when disconnecting air lines</li> <li>• Do not open nitrogen cylinder in confined area and use adequate ventilation</li> </ul>	Sampling Technician
9	Collect samples in accordance with sampling plan	<ul style="list-style-type: none"> <li>• Cross-contamination</li> <li>• Lifting hazards</li> <li>• Back injury</li> <li>• Manual material handling</li> <li>• Inhalation or dermal exposure to chemical hazards</li> <li>• Slip/trip/fall hazards</li> <li>• Improper labeling or storage</li> <li>• Injury due to acid burn (unsealed or leaking sample bottle)</li> <li>• Injury from broken sample bottle (cuts or acid burn)</li> </ul>	<ul style="list-style-type: none"> <li>• Wear Ndex nitrile gloves over top of a glove approved by the ANSI Cut and Abrasion Resistance Level 2 EN 388 21xx Testing Standard</li> <li>• Decontaminate sampling equipment between each well (unless disposable)</li> <li>• Refer to step 9 and the HASP for additional lifting methods</li> <li>• Label samples in accordance with sampling plan</li> <li>• Keep samples stored in proper containers, at correct temperature, and away from work area</li> <li>• Wear nitrile gloves when handling bottles</li> <li>• Handle bottles carefully</li> </ul>	Sampling Technician
10	Dispose or store purge water on site	<ul style="list-style-type: none"> <li>• Lifting hazards</li> <li>• Back injury</li> <li>• Manual material handling</li> <li>• Exposure to chemicals</li> <li>• If disposing through on-site treatment system, damage or injury from improper use of equipment</li> <li>• Improper storage or disposal</li> </ul>	<ul style="list-style-type: none"> <li>• Use proper equipment to transport water (pumps, drum dollies, etc.)</li> <li>• Refer to step 9 and the HASP for additional lifting methods</li> <li>• Wear Ndex nitrile gloves over top of a glove approved by the ANSI Cut and Abrasion Resistance Level 2 EN 388 21xx Testing Standard</li> <li>• Review any necessary instructions for use of on-site treatment systems</li> <li>• Label storage containers properly and locate in isolated area away from traffic and other site functions</li> <li>• Coordinate off-site disposal (where applicable)</li> </ul>	Sampling Technician



# JOB SAFETY ANALYSIS (JSA)

## Groundwater Sampling with Bladder Pump



Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Mitigating Measure(s) <sup>(3)</sup>	Person Responsible
11	Clean site/demobilize	<ul style="list-style-type: none"><li>Traffic</li><li>Nuisance or safety hazard left on site</li><li>Back strain</li></ul>	<ul style="list-style-type: none"><li>Wear Ndex nitrile gloves over top of a glove approved by the ANSI Cut and Abrasion Resistance Level 2 EN 388 21xx Testing Standard</li><li>Use buddy system as necessary to remove traffic control</li><li>Leave site clean of refuse and debris</li><li>Notify station personnel of departure, and note any purge water left on site</li><li>Exercise caution when lifting coolers out of the trunk of a car; use the buddy system if justified</li></ul>	Sampling Technician
12	Package and deliver samples to lab	<ul style="list-style-type: none"><li>Bottle breakage</li><li>Improper temperature</li><li>Exceeding hold times</li><li>Improper completion of Chain of Custody (COC)</li></ul>	<ul style="list-style-type: none"><li>Wear Ndex nitrile gloves over top of a glove approved by the ANSI Cut and Abrasion Resistance Level 2 EN 388 21xx Testing Standard</li><li>Pack samples in ice, use bubble wrap/bags for sample bottles</li><li>Use standard COC forms and labels</li><li>Submit samples to lab as soon as possible (no more than 3 days, but check sampling plan for any special requirements such as rush turnaround or special hold time restrictions)</li></ul>	Sampling Technician

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



## JOB SAFETY ANALYSIS (JSA)

### Landfill Gas Monitoring



Safety Means Awareness  
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

<b>Date Issued/Revised:</b>	3-1-09	<b>JSA Type:</b>	Landfill Gas Monitoring and Inspection
<b>Work Type:</b>	Environmental	<b>Client:</b>	Weyerhaeuser Company
<b>Work Activity:</b>	Landfill gas monitoring and landfill gas system inspection		
<b>Work Site:</b>	12 <sup>th</sup> Street Landfill, Otsego, Michigan		
<b>Key Equipment:</b>	Landtec landfill gas monitor, manometer, 4-gas meter		
<b>Task-specific Training:</b>	HAZWOPER, Landfill Gas Monitoring		

<b>MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)</b>						
<input checked="" type="checkbox"/> Reflective Vest	<input type="checkbox"/> Goggles	<input checked="" type="checkbox"/> Gloves*	<b>Supplied Air</b>	<b>APR</b>		
<input checked="" type="checkbox"/> Hard Hat	<input type="checkbox"/> Face Shield*	<input type="checkbox"/> Coveralls*	<input type="checkbox"/> SCBA	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Particulate	<input type="checkbox"/> Organic Vapor
<input type="checkbox"/> Lifeline/Harness*	<input type="checkbox"/> Hearing Protection*	<input type="checkbox"/> PPE Clothing*	<input type="checkbox"/> Airline Respirator (attach description)	<input type="checkbox"/> Half Mask APR	<input type="checkbox"/> Particulate/Organic Vapor Combined	
<input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Safety-toed Boots				<input type="checkbox"/> Acid Gas	
<input type="checkbox"/> Other*		<input type="checkbox"/> Other*		<input type="checkbox"/> Other*		
<b>ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)</b>						
<b>Upgrade/down grade of PPE will be based on action levels in Tables 5.1 and 5.2 of HASP.</b>						
<b>Please refer to Section 5.0 of the HASP for additional PPE information</b>						

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					



# JOB SAFETY ANALYSIS (JSA)

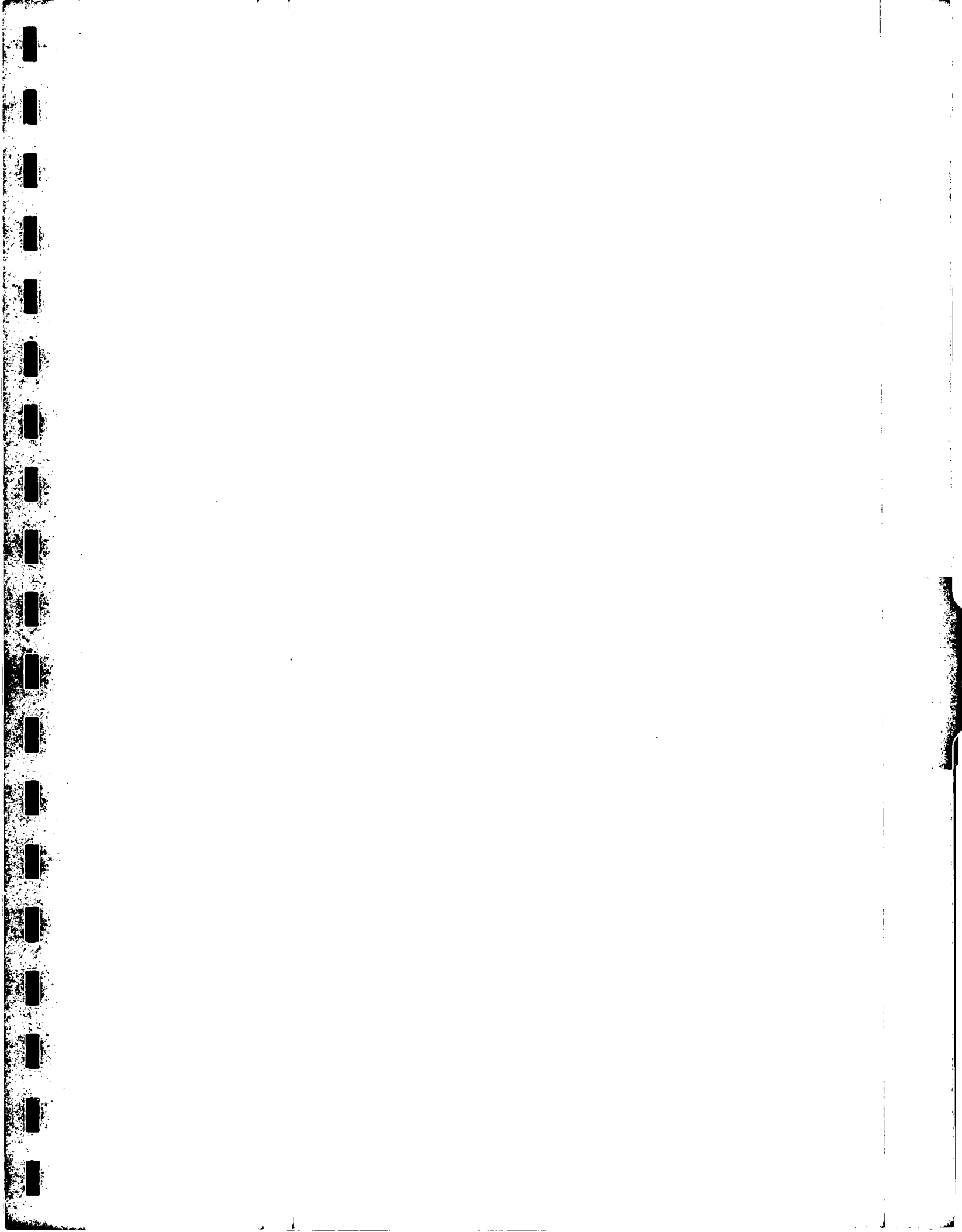
## Landfill Gas Monitoring



Safety Means Awareness  
Responsibility Teamwork

Job Steps <sup>(1)</sup>	Task Activity	Potential Hazard(s) <sup>(2)</sup>	Corrective Measure(s) <sup>(3)</sup>	Person Responsible
1	Inspect/calibrate monitoring equipment	<ul style="list-style-type: none"> <li>Loss due to malfunctioning equipment</li> </ul>	<ul style="list-style-type: none"> <li>Check all equipment to ensure it is in proper working order and has been calibrated to CRA and manufacturer's standards, then document</li> </ul>	Technician
2	Establish work zone at monitoring location	<ul style="list-style-type: none"> <li>Pinch points</li> <li>Lifting hazards</li> <li>Back injury</li> <li>Manual material handling</li> </ul>	<ul style="list-style-type: none"> <li>Be aware of uneven terrain while walking</li> <li>Reduce travel distance when there is a need to carry/lift materials.</li> <li>Make sure grip is adequate; wear leather/cotton gloves when setting up barricades</li> <li>Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required</li> <li>Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position</li> <li>Avoid one-handed carrying if possible; maintain awareness of footing</li> </ul>	Technician
3	Open monitoring location cover (if applicable)	<ul style="list-style-type: none"> <li>Pinch points</li> <li>Hand injury</li> <li>Lifting hazards</li> <li>Back injury</li> <li>Manual material handling</li> <li>Biological hazards</li> </ul>	<ul style="list-style-type: none"> <li>Avoid placing hands in pinch points</li> <li>Wear proper PPE (gloves) for task if necessary and use proper tool(s) when opening well covers (open face wrench/socket wrench)</li> <li>Refer to step 2 and the HASP for additional lifting information</li> <li>Inspect for other hazards that may affect the hands (hypodermic needles, etc.)</li> <li>Heightened awareness of wasps, ants, bees, spiders, and poison plants</li> </ul>	Technician
4	Measure pressure and landfill gas composition	<ul style="list-style-type: none"> <li>Contaminant exposure</li> <li>Biological hazards</li> </ul>	<ul style="list-style-type: none"> <li>Point Landtec landfill gas monitor outlet away from people monitoring</li> <li>Heightened awareness of wasps, ants, bees, spiders, and poison plants</li> </ul>	Technician
5	Measure water levels (if required)	<ul style="list-style-type: none"> <li>Contaminant exposure</li> <li>Biological hazards</li> </ul>	<ul style="list-style-type: none"> <li>Wear proper PPE (nitrile gloves)</li> <li>Decon probe and measuring tape following gauging of probe</li> </ul>	Technician
6	Record reading	<ul style="list-style-type: none"> <li>Contaminant exposure</li> <li>Slip/trip/fall hazards</li> </ul>	<ul style="list-style-type: none"> <li>Maintain housekeeping; be aware of ground conditions</li> <li>Keep hands away from pinch points</li> </ul>	Technician
7	Close monitoring location cover (if applicable)	<ul style="list-style-type: none"> <li>Pinch points</li> <li>Hand injury</li> <li>Lifting hazards</li> <li>Back injury</li> <li>Manual material handling</li> <li>Biological hazards</li> </ul>	<ul style="list-style-type: none"> <li>Avoid placing hands in pinch points</li> <li>Wear proper PPE (gloves) for task if necessary and use proper tool(s) when opening well covers (open face wrench/socket wrench)</li> <li>Refer to step 2 and the HASP for additional lifting information</li> <li>Inspect for other hazards that may affect the hands (hypodermic needles, etc.)</li> <li>Heightened awareness of wasps, ants, bees, spiders, and poison plants</li> </ul>	Technician

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



APPENDIX F

LANDFILL INSPECTION FORM TEMPLATE  
LANDFILL REPAIR FORM TEMPLATE



OPERATION AND MAINTENANCE INSPECTION FORM  
12th STREET LANDFILL SITE, OPERATIONAL UNIT 4  
ALLIED PAPER/PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE  
481 12th STREET  
PLAINWELL, MICHIGAN

Page 1 of 2

Date: \_\_\_\_\_

Weather: \_\_\_\_\_

Inspector: \_\_\_\_\_

Inspection Item

Inspect For

Comments and Remarks:

(Note if repair/maintenance is recommended, describe its location/extent and identify on Maintenance Repair Form. If no deficiency, note as such).

**1. Landfill Cover**

- |                              |   |
|------------------------------|---|
| Vegetated Soil Cover         | <ul style="list-style-type: none"><li>- erosion</li><li>- exposure of the liner or geotextile</li><li>- areas of insufficient vegetation coverage</li><li>- dead/dying vegetation</li><li>- washouts</li><li>- leachate outbreaks</li><li>- settlement causing ponding of water</li><li>- slope instability</li><li>- burrowing by animals</li><li>- rooting of trees</li></ul> |
| Access Roads/Drainage Swales | <ul style="list-style-type: none"><li>- erosion</li><li>- obstructions or sediment build up</li><li>- exposed geotextile</li><li>- puddles</li><li>- debris</li><li>- damage caused by vehicular traffic</li></ul>  |
| Rip Rap at River side        | <ul style="list-style-type: none"><li>- erosion</li><li>- exposure of geotextile</li></ul>  |

**2. Storm Water Management System**

- |                              |  |
|------------------------------|--|
| Access Roads/Drainage Swales | See Landfill Cover   |
| Check Dams                   | <ul style="list-style-type: none"><li>- erosion</li><li>- obstructions or sediment build up</li><li>- exposed geotextile</li><li>- puddles</li><li>- debris</li><li>- damage</li></ul> |
| Spillways/outlets            | <ul style="list-style-type: none"><li>- silt accumulation</li><li>- erosion</li><li>- obstructions</li></ul>   |

**3. Landfill Gas Control System Maintenance**

- |            |  |
|------------|--|
| Gas Vents  | <ul style="list-style-type: none"><li>- structural integrity, identification labels</li><li>- general observations</li></ul> |
| Gas Probes | <ul style="list-style-type: none"><li>- structural integrity, identification labels, locks</li></ul>                         |

OPERATION AND MAINTENANCE INSPECTION FORM  
12th STREET LANDFILL SITE, OPERATIONAL UNIT 4  
ALLIED PAPER/PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE  
481 12th STREET  
PLAINWELL, MICHIGAN

Page 2 of 2

*Inspection Item*

*Inspect For*

*Comments and Remarks:*

*(Note if repair/maintenance is recommended, describe its location/extent and identify on Maintenance Repair Form. If no deficiency, note as such).*

- 
- general observations

**4. Landfill Monitoring Well Network Maintenance**

- Monitoring Wells
- structural integrity, identification labels, locks
  - general observations

**5. Other Pertinent Observations**

- Staff Gauge
- structural integrity, numbers visible
- Site Access Controls
- integrity of fence
  - integrity of gate
  - integrity of lock
  - placement and condition of signs
- Other

Signed: \_\_\_\_\_

OPERATION AND MAINTENANCE REPAIR FORM  
12<sup>th</sup> STREET LANDFILL SITE OPERATIONAL UNIT 4  
ALLIED PAPER/PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE  
481 12<sup>th</sup> STREET  
PLAINWELL, MICHIGAN

Landfill Management System (circle one):    Gen. Site        Final Cover        Storm Water        Landfill Gas        Monitoring Well

Date Problem Identified: \_\_\_\_\_

Description of Problem: \_\_\_\_\_  
\_\_\_\_\_

Description of Maintenance or Repair Taken (Type, Location, Extent)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Date(s) of Maintenance Repair: \_\_\_\_\_

Inspector(s): \_\_\_\_\_

Signed: \_\_\_\_\_